

THE MAYFLIES OF THE MOUNT KOSCIUSKO REGION. I.  
(PLECTOPTERA.)

INTRODUCTION AND FAMILY SIPHLONURIDAE.

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(Plate i; forty-five Text-figures.)

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*Introduction.*

Like South Africa and other countries subject to periods of drought, Australia is on the whole extremely poor in Mayflies. This is clearly due to the fact that the larvae, or nymphs, of most kinds of Mayflies require running water in which to live. It might reasonably be expected, therefore, that those parts of Australia where perennial, fast-running streams exist would prove an exception to the general rule. The most elevated region in the whole of Australia, and the one which possesses the most rapid rivers, is the Mount Kosciusko range in the extreme south of New South Wales.

The Mayfly fauna of this region first attracted my attention in 1905. Mayflies, however, are not like dragonflies, easily collected and worked out systematically. Most of the adults have an extremely short life, and one would be extremely fortunate if, during the course of a short visit to the mountain, one happened to strike the exact time of year at which a particular adult Mayfly was on the wing. Further, very few of the Australian species of Mayflies occur in large numbers or fly in swarms, and I suspect that some of them are nocturnal in their habits. Thus the collector of these insects will meet at the start with the very annoying but unavoidable experience of collecting large numbers of larvae or nymphs in the streams and finding himself unable, except at the inconvenience of a prolonged stay, to determine the adult form, either by rearing the larvae or by observing the actual emergence of the fly on the streams. To take an example—the nymphs of the huge species of *Coloburiscus* described in this paper were first discovered by me on Diggers' Creek (5,000 ft. level) in January, 1905. During a number of subsequent visits I endeavoured to rear or otherwise discover the imago. Visits in late November, late December and early January all indicated that this species most probably did not emerge until February. It was not until 1929 that I was able to arrange a visit which lasted into the first week of that month, when I discovered that the adult Mayfly emerged between sunset and sunrise and almost immediately rose into the air and disappeared into the bush far away. The following year I timed my visit a little later, and secured a fine haul of subimagos. Not a single imago, however, was seen at any time, and those which I possess were all reared by keeping the subimagos in large tins, resting on reed-stems stuck into a layer of wet sphagnum moss. By

this method, it seemed at last that the problem of the giant Mayfly of Mt. Kosciusko had been solved. However, a further visit was made in company with Professor W. M. Wheeler early in December, 1931, at a time of year at which I had never previously visited the mountain. Much to my surprise, I found, in the same locality on Diggers' Creek, and elsewhere, a number of evidently full-grown nymphs of *Coloburiscus*, apparently indistinguishable from those found in February. In a day or two, these began to emerge in small numbers, when they were found to consist of an almost equally large but entirely distinct species, with a differently coloured subimago.

In my book on Australian Insects (1926, p. 61), I have listed four families of Mayflies as occurring in Australia, viz., Siphonuridae, Ephemeridae, Leptophlebiidae and Baëtidae. This list has now to be modified in at least two directions. Firstly, the minute Mayflies of the family Brachycercidae have been recorded from Tasmania by Lestage (1930), and I am also able to state that they occur in swarms on the Murrumbidgee River not far from Canberra. Secondly, the record for the family Ephemeridae was based on two larvae discovered by me in 1917 in the Fish River, N.S.W., but never described or reared. These larvae were of the burrowing type, with large calliper-like projections in front of the head. Unfortunately, the tube containing them was lost when I moved to New Zealand; but I never had any doubt that they belonged to the Ephemeridae. Quite recently, in dredging in the Murrumbidgee River in gravelly rapids and under loose rocks, I rediscovered this same larva. On examination, I was astonished to find that the large calliper-like processes are not part of the mandibles at all, as they are in the Ephemeridae, but are frontal projections designed to serve the same purpose, viz., to burrow down into the river-bed. It is now clear that this larva does not belong to the Ephemeridae at all, but is probably a highly specialized type developed from the Leptophlebiidae.

It is, of course, quite probable that true species of Ephemeridae occur in Australia. If so, they have not yet been discovered. Likely localities in which to search for them appear to me to be Western Australia and also the Cape York Peninsula and the large, rapid rivers as far south as the Bellenden Ker Range.

A further addition to the Australian Mayfly fauna may still be necessary, owing to the discovery in the Cotter River, near Canberra, of a single specimen of an entirely new type of Mayfly nymph which I am at present unable to place in any recognized family.

The foregoing account will have made clear one important point, viz., that it is much easier to discover new types of Mayfly nymphs than it is to determine their corresponding imagos. Following the example of Needham and his school, it is now quite usual, not only to found new genera on nymphal characters alone, but also to describe new genera and species from nymphal forms, leaving it to the effluxion of time to provide information about the imagos. A striking recent example of the success of this method was the discovery and description of the European genus *Torleya* (Lestage, 1917). Much as one may dislike basing generic and specific descriptions on larval forms, it seems to be the right method of attack in studying a group like the Mayflies, where the life of the imago has been reduced to an extremely short period and the whole struggle for existence has been transferred to the larva. It is, indeed, absolutely true that, in most cases, the Mayfly nymph provides much more reliable characters for classification than does the imago. Lestage's diagnosis of *Torleya* from the characters of its

nymph proved to be extraordinarily correct when, later on, the imago was fortunately discovered.

A prejudice against the method of describing Mayfly nymphs without their corresponding imagos has, I confess, hitherto prevented me from attempting to write an account of the Mount Kosciusko species. Now, however, I have no further excuse, for the imagos of all the more important species have at last been determined.

The present paper will deal entirely with the Mayflies of the Mount Kosciusko region from the summit down to about the 3,000 ft. level, the lower boundary being taken along the Snowy and Thredbo Rivers to their junction at Waste Point, not far from "The Creel". The highest points at which Mayfly nymphs have been taken are Lake Cootapatamba (6,600 ft.), Lake Albina (6,350 ft.) and the Blue Lake (6,200 ft.). Specimens of adult Siphonuridae have been taken by me resting on rocks above snow, not far from the summit, at 7,000 ft. The Mayfly fauna of these Alpine lakes is of very great interest, the dominant forms being Siphonuridae.

Only two families are so far known to occur on Mount Kosciusko, viz., the Siphonuridae and the Leptophlebiidae. Brachycercidae certainly occur lower down along the Snowy River, round about Jindabyne, and probably Baëtidae also, so it may be possible to add these two families to the record later on. In this part, I propose to deal only with the Siphonuridae, which form the dominant group of this elevated region and include some of the largest and finest Mayflies in the whole world.

In attempting to classify the known Australian types of this family, one is faced immediately with the fact that they are very closely allied to the New Zealand forms of the same family, and that these latter forms are still in need of revision, in spite of the excellent work recently carried out on them by Captain J. S. Phillips (1930). Acting on a suggestion made to him by me *in litt.*, this author has removed *Ameletus perscitus* Eaton from the genus *Ameletus* and made it the type of the genus *Ameletopsis* Phill., a proceeding fully justified. This leaves two New Zealand species still within the genus *Ameletus*, viz., *A. ornatus* Eaton and *A. flavitinctus* Till. The type of the genus *Ameletus*, however, is *A. subnotatus* Eaton from Colorado, U.S.A. It has for long appeared to me unlikely that the New Zealand species belonged to the same genus as the American type. Through the kindness of Dr. J. MacDunnough of the Division of Entomology, Ottawa, Ont., Canada, I have recently received material in alcohol of both adults and nymphs of this and other closely related North American genera. A study of these reveals the fact that the New Zealand species are not congeneric with them, as I long ago suspected.

It seems best, therefore, in defining the Australian genera, to bring the New Zealand forms into the discussion and to construct keys which will include both the Australian and New Zealand forms, both for adults and for nymphs. It will then be clearly seen that there is only a single genus common to the two countries, viz., *Coloburiscus* Eaton, which is the dominant and most widely spread genus of the family in both, and that the other genera, though closely related, are quite distinct from one another. A new generic name is required for the New Zealand species at present placed in *Ameletus* Eaton; for these I propose the name *Nesameletus*, n.g., fixing the genotype as *Ameletus ornatus* Eaton. The other New Zealand genera are *Oniscigaster* McLach., *Ameletopsis* Phill., and *Coloburiscus* Eaton.

## Family SIPHLONURIDAE.

*Adults.*—Forewing with the tornus at from two-fifths to nearly one-half of the wing-length, with vein CuA straight or nearly so, ending up just beyond tornus and provided with a pectinate series of descending branches; CuP short and curved concavely to CuA. Hindwing comparatively large, from one-third to one-half as long as forewing, its venation complete, with triads present on Rs and MA. Turban eyes never present in males. Subimago able to live in a quiescent manner for a period ranging from two to four days.

*Nymphs.*—Free-living, non-burrowing types, with the mandibles not provided with tusks; habits either free-swimming or else clinging to rocks in fast-running streams; vegetarian or carnivorous. Gills usually simple, held either laterally or dorsally. Tarsal claws usually smooth. Tail-filaments short to medium (not longer than the body). Metamorphosis usually takes place while the nymph is at rest on a rock, stone, reed-stem or on the bank of the stream just above water-level.

In dealing with the wing-venation of the adults (Text-figs. 1, 17, 28, 32, 43), I have adopted the Revised Notation as set out in my most recent work on fossil Mayflies (1932). In this notation, the two elements of the media are clearly distinguished, viz., the anterior convex median, MA, and the posterior concave median, MP, the latter corresponding with Comstock's media M in most Orders. The limits of the radial sector, Rs, are clearly defined if one remembers that the base of this vein, in all recent Mayflies, has been secondarily captured by the upwardly arching stem of MA. In order to bring the terminology of the cubitus into line with that of the media, the anterior convex cubitus, hitherto called Cu<sub>1</sub>, is now termed CuA, while the posterior concave cubitus, hitherto known as Cu<sub>2</sub>, is termed CuP. The anal veins are termed A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub> and A<sub>4</sub>, respectively, so as to allow of the use of the prefix "I" for intercalated sectors. The term "triad" is used for a dichotomy of a main vein together with an included intercalated sector of opposite sign; this latter vein always takes the prefix "I" and is named from the vein just anterior to it. The complete venational scheme for the family can be studied in Text-figures 1, 17, 32.

*Key to the Australian and New Zealand Genera.*

## Adults.

1. In forewing MP<sub>2</sub> and frequently also IMP are attached basally to CuA. Tarsal claws alike, both sharp. Three well-developed tail-filaments in both sexes, the appendix dorsalis being nearly as long as the cerci. (Hindwing with costa only slightly angulated near base.) ..... *Ameletoides*, n.g.  
     In forewing, MP<sub>2</sub> and IMP are normal, not attached to CuA. Tarsal claws dissimilar, one sharp and one blunt. Appendix dorsalis either much shorter than cerci, obsolescent, or entirely absent ..... 2
2. Tarsi apparently only four-segmented (the true basal segment of the tarsus being fused with the tibia) ..... *Tasmanophlebia* Till.  
     Tarsi clearly five-segmented ..... 3
3. Hind tarsus shorter than tibia. Hindwing with costa very strongly angulated near base ..... *Coloburiscus* Eaton.  
     Hind tarsus longer than tibia. Hindwing with costa either weakly angulated or rounded near base ..... 4
4. Comparatively stout-bodied species, with or without lateral dilations of the abdominal segments. Appendix dorsalis present, but much shorter than the cerci ..... *Oniscigaster* McLach.  
     More slender-bodied forms, with cylindrical abdominal segments. Appendix dorsalis either obsolescent or entirely absent ..... 5
5. Cross-veins very numerous and regularly spaced; pterostigma with branched veinlets forming a double series. Genital forceps of male with only three segments ..... *Ameletopsis* Phill.

Cross-veins much less numerous and irregularly spaced; pterostigma with a single series of unbranched veinlets. Genital forceps of male four-segmented.  
 ..... *Nesameletus*, n.g.

Nymphs.

1. Nymphs clinging to rocks in rapids. Thorax strongly humped, very broad. Gills deeply bifid, held vertically over abdomen. .... *Coloburiscus* Eaton.  
 Nymphs free-swimming, shrimp-like. Thorax not exceptionally broad, either not humped or only slightly so. Gills lamellate ..... 2
2. Nymphs dorso-ventrally flattened, the gills carried dorsally on the abdominal segments ..... 3  
 Nymphs slightly laterally flattened, the gills carried laterally ..... 4
3. Six or seven pairs of gills, on abdominal segments 1-6 or 1-7 respectively, all lamellate and resting flatly upon the abdomen ..... *Oniscigaster* McLach.  
 Only four pairs of gills, on segments 1-4 respectively; of these, the first pair are large and opaque, forming an operculum or protective covering for the other three pairs ..... *Tasmanophlebia* Till.
4. Nymphs carnivorous, with huge head and large eyes; incisors of mandible separate, each subdivided into two sharp prongs; palpi with numerous small segments ..... *Ameletopsis* Phill.  
 Nymphs plankton feeders, with normal head; incisors of mandibles fused together into a single blunt tooth; palpi normal, three-segmented ..... 5
5. Tarsal claws with fine serrations underneath. Appendix dorsalis markedly shorter than cerci ..... *Nesameletus*, n.g.  
 Tarsal claws smooth. The three tail filaments of approximately equal length. .... *Ameletoides*, n.g.

It will be seen that the nymphs fall into three well marked types, each of which is represented in both countries, as follows:

Type of Nymph.	Genera.	
	Australia.	New Zealand.
1. Slow, free-swimming type, dorso-ventrally flattened; gills held dorsally flat above the abdomen.	<i>Tasmanophlebia</i> Till.	<i>Oniscigaster</i> McLach.
2. Fast, free-swimming type, laterally flattened; gills held laterally.	<i>Ameletoides</i> , n.g.	<i>Nesameletus</i> , n.g. <i>Ameletopsis</i> , n.g.
3. Sedentary type, clinging to rocks in rapids, with huge, humped thorax and gills bilobed and held vertically above the abdomen.	<i>Coloburiscus</i> Eaton.	<i>Coloburiscus</i> Eaton.

Thus it can be seen that, while *Coloburiscus* is represented in both countries by closely similar forms, *Tasmanophlebia* is the Australian representative of *Oniscigaster*, and *Ameletoides* is the Australian representative of *Nesameletus*. A single nymph of the *Ameletopsis* type has been captured in a tributary of the Cotter River, near Canberra, F.C.T., but is not dealt with in this paper.

Genus AMELETOIDES, n.g. Text-figs. 1-11; Plate i, figs. 1-2.

*Adult*.—Forewing (fig. 1) with tornus at about two-fifths of wing-length; MP<sub>2</sub> is secondarily attached to CuA; bullae present. Hindwing (fig. 1) distinctly less than half as long as fore, its costa only slightly angulated near base. Venation of both wings delicate but well formed, the cross-vein system being quite as strongly chitinized as the greater portion of the main veins. Forelegs (fig. 2A) of the male imago longer than the body, about as long as the forewing; those of female imago shorter than the body. Tarsal claws (fig. 2B) of all legs similar, both sharply pointed, smooth. Tarsi with first segment shorter than the second;

the hind tarsi about equal in length to the hind tibiae. Three tail-filaments present, the appendix dorsalis almost as long as the cerci.

*Nymph* (fig. 4).—Free-swimming, rather shrimp-like, somewhat laterally flattened and with thorax slightly humped (machiloid type). Head small, hypognathous, the eyes lateral, the antennae short; mandibles (fig. 6) with a single large incisor; maxillary and labial palpi three-segmented. Abdomen tapering posteriorly; seven pairs of gills (fig. 10), one pair on each of segments 1-7; gills simple, lamellate, consisting of an oval portion, supported by a chitinized rim, and an unsupported dorsal flange; tail-filaments (fig. 11) short, about half as long as the body.

Genotype, *Ameletoides lacus-albinae*, n. sp.

*Habitat*.—Lake Albina, Mount Kosciusko Range, 6,350 ft.

This interesting genus, which appears to be maintaining the last stage of a precarious existence in Lake Albina, to which the introduced trout has not yet penetrated, is undoubtedly the Australian representative of the group which passes at present under the generic name of *Ameletus* in New Zealand, but for which a new generic name (*Nesameletus*, n.g.) is being proposed in this paper. It can, however, be distinguished at once from the New Zealand forms by certain characters both of the adult and the nymph. In the adult, the tarsal claws are similar, both sharp; those of the New Zealand forms I find to be definitely dissimilar. Both subimago and imago have the appendix dorsalis well preserved, nearly as long as the cerci; in the New Zealand forms, the appendix dorsalis is reduced to a mere remnant. In the nymph, the single incisor of the mandible is very broad and truncated, and the prostheca is inserted almost in contact with it; the three tail-filaments are of almost equal length.

AMELETOIDES LACUS-ALBINAЕ, n. sp. Text-figs. 1-11.

*Imago*. Text-figs. 1-3.

♂ (dried): total length (excluding tail-filaments) 14.0 mm.; abdomen 9.7 mm.; forewing 14 mm.; hindwing 6 mm.; cerci 17 mm.; appendix dorsalis 15 mm.

Head (somewhat shrivelled) small, black above, mostly brownish below and in front; eyes black with pale brownish rims; ocelli colourless, glassy, the median one much smaller than the laterals; antennae blackish, set in pale brown toruli.

Thorax shining black above; sides partly black and partly brownish; sternites brownish-black. Legs: forelegs 14 mm. long, femur dark brown with black knee, tibia dark brown shading to black distally, tarsus black; femur about 4 mm. long, tibia somewhat shorter, tarsal segments in descending order of length 3, 2, 4, 1, 5; middle and hind legs only about half as long, femora and tibiae pale semi-transparent brownish, knees broadly black, tarsi shading to blackish; tarsal segments in descending order of length, 1 = 2, 5, 3, 4; tarsal claws (fig. 2B) both sharp, similar, inner margins broadly curved, with a sharply angulated flange of delicate, transparent chitin.

Wings (fig. 1) brilliant, the membrane hyaline, the veins well-chitinized, brownish, except in the anal areas, where they are weak and almost colourless. A slight brownish tinge is present in the pterostigmatic area of forewing. Cross-veins moderately numerous, very irregularly placed.

Forewing (fig. 1) with 11-14 pterostigmatic veinlets, usually single, but a few may be connected by cross-bars; two bullae present, the anterior about half-way along Sc, the posterior immediately below it at the origin of R<sub>3</sub>. The most interesting venational feature of the forewing is the attachment of MP<sub>2</sub> to CuA

(fig. 1); in some specimens IMP is incomplete basally, in others (as in the one figured) it is attached basally to MP<sub>2</sub>, and thus it appears at first sight almost as if this triad belonged to CuA instead of to MP. Hindwing (fig. 1) with the humeral angle well-formed, obtuse, slightly rounded; the costal space markedly narrowed just before half-way; triad of MP arising close to base, very large and deep.

Abdomen: segment 1 as broad as thorax, to which it is closely applied, black; segments 2-9 strongly banded, basally pale brown, distally black; segment 10 pale brownish. Genitalia as in figure 3, the penis pale brownish, large, with widely diverging lobes; forceps-basis broad, pale brownish; forceps with four segments, brownish basally darkening to blackish on last two segments; first segment broad, short; second segment narrower, very long; third segment narrow, cylindrical, about as long as first; fourth segment shorter than third, narrow, cylindrical with rounded tip. Tail-filaments with about 50 segments, pale brownish with blackish annulations at the joints.

♀ (dried): total length 14 mm.; forewing 16 mm.; hindwing 7 mm.; cerci 14 mm.; appendix dorsalis 12 mm. Differs from the male in the smaller eyes, the thorax with rich brown markings above, the forelegs only 11 mm. long and having the segments of the tarsus, in descending order of length, 1 = 2, 3, 5, 4; forewings somewhat paler with a tinge of lemon-yellow in the pterostigmatic area; abdomen somewhat broader basally and more tapering distally; subanal plate trapezoidal, its free distal margin strongly emarginate.

*Subimago.* Plate i, figs. 1, 2.

The chief difference between subimago and imago in both sexes is the coloration of the wings, which, instead of being hyaline, are dull and irregularly mottled all over with fuscous streaks and blotches. In general, each crossvein is surrounded by a narrow band of fuscous, on which it stands out as a pale, whitish line. In certain parts of the wing, these dark bands tend to run together, forming blotches; in the forewing, there is a blotch over the two bullae, a wider one below the pterostigma, one across the triad of MA, another below the end of A<sub>1</sub>, and there is more or less coalescence along the distal margin, in the costal and subcostal spaces and below MP<sub>1</sub>; in the hindwing, most of the bands in the distal half have coalesced and some of those in the basal half also. Generally speaking, the mottling is darker in the male than in the female, and there is also more coalescence of individual bands. The forelegs of the male are considerably shorter than in the imago, and the tail-filaments of both sexes are much shorter also, the cerci being about 10 mm., the appendix dorsalis about 8 mm. and both appearing rather shrivelled.

*Nymph.* Text-figs. 4-11.

Total length (excluding tail-filaments) 14.4 mm. Cerci 5 mm., the appendix dorsalis almost equally long.

General form (fig. 4) somewhat shrimp-like, slightly compressed laterally, with thorax slightly humped (machiloid type). Colour a uniform fuscous above, shading to brownish below; gills greyish-white.

Head moderately large, hypognathous, with large, oval, black eyes and very short antennae (1.5 mm.). Mouth-parts: Labrum (fig. 5) about twice as wide as long, distal margin well rounded laterally, emarginate medially. Mandibles (fig. 6) of markedly different shape, the right one being wider and more triangular than the left; in both there is only a single large, turret-like incisor,

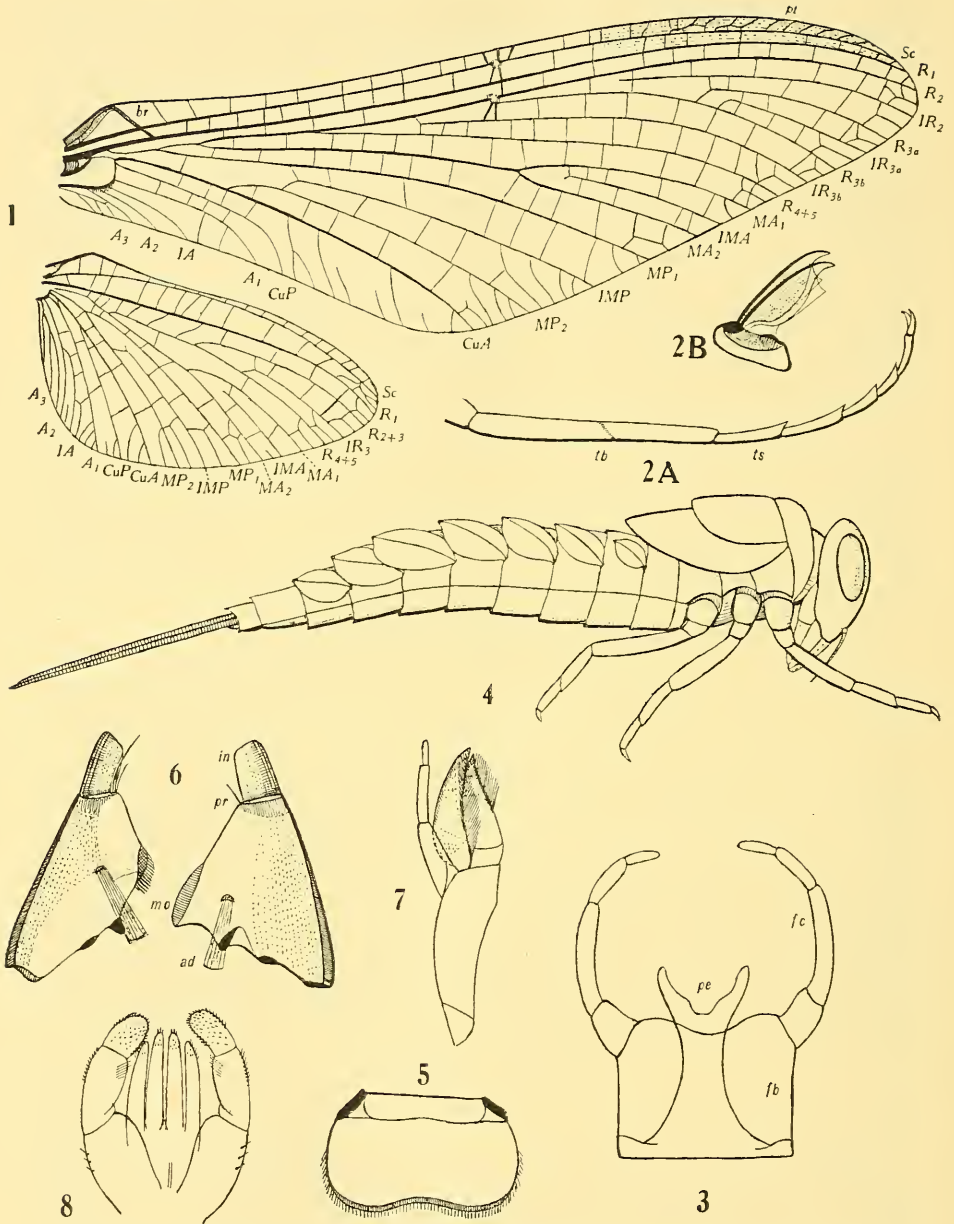


Fig. 1.—*Ameletoides lacus-albinae*, n.g. et sp. Venation of male imago. Revised Notation:  $A_1$  to  $A_4$ , anal veins; CuA, anterior or first cubitus (convex); CuP, posterior or second cubitus (concave); MA, anterior median (convex); MP, posterior median (concave). The prefix "I" indicates an interpolated vein forming the middle member of a triad; such a vein is of opposite sign to that of the two veins enclosing it. Length of forewing, 14 mm. ♀



very strongly and somewhat obliquely truncated distally; almost touching the base of the incisor, on its inner side, is a short bristle representing the prostheca, and, in the left mandible only, there is a longer bristle arising even closer to the incisor and reaching beyond its apex; molar area of left mandible a rather short combined grid and comb, the latter with about ten closely-set, slender prongs, slightly curved at their tips; molar area of right mandible a much longer but shallower grid only. Maxillae (fig. 7) with three-segmented palp, the basal segment being the longest and broadest, the second slightly shorter, much narrower, cylindrical, the distal segment very short and narrower still, somewhat blunt at apex; galea and lacinia about of equal length, with their apices close together, distal half of inner margin of lacinia with a fringe of stiff hairs. Labium (fig. 8) with stout, three-segmented palps, the basal segments longest and widest, bare except for two or three small, short setae near outer margin, the second segment about two-thirds as long and not so wide, also almost bare but with a small group of extremely delicate hairs near distal part of inner margin, the distal segment short and fairly well rounded, with numerous short setae more especially congregated on and near the distal margin; paraglossae narrow, very elongated, reaching the middle of inner margin of distal segment of palps, tips with delicate hairs and a few very short setae; glossae similar in form to the paraglossae but extending slightly beyond them, tips with a mass of minute sensillae, two or three of which project as short, stout, blunt rods. Hypopharynx extremely delicate and almost colourless, broad and rather truncate distally, the pragnaths (superlinguae) well developed, covered with fine hairs and carrying also a minute ridge of tiny teeth.

Thorax somewhat swollen and humped, the prothorax short and fairly wide, convex above, the mesothorax not quite as long as broad, the wing-sheaths broad and ending above the abdomen between the first pair of gills, the metathorax short and for the most part hidden. Legs (fig. 9) set fairly close together, the coxae short and stout, the trochanters short but well developed, the femora nearly as long as tibia and tarsus combined, broad and fairly flat; tibia partly divided into two by an oblique groove; tarsus slightly shorter than tibia, the claw (fig. 2B) smooth, well pointed, with a row of five or six minute dots or tubercles about middle of distal part.

Abdomen tapering markedly towards the posterior end, the segments becoming longer from 1 to 4, then approximately equal in length from 4 to 9, 10 very short; there is no dorsal crest or carina; posterior lateral angles of segments 3-9 inclusive end in a small, sharp spine; posterior margins of segments 4-9 inclusive are finely crenulated. Gills (fig. 10), seven pairs, one pair on each of segments 1-7 inclusive, increasing in size from the first to fifth pairs, then decreasing; the first pair are the smallest. Each gill is inserted on the postero-lateral margin just dorsally from the actual angle; it consists of a single broadly oval lamella having its ventral margin strongly chitinized and its dorsal margin membranous;

Fig. 2.—*Ameletoides lacus-albinae*, n.g. et sp. Legs of male imago. 2A—Tibia and tarsus of foreleg; *tb* tibia, *ts* tarsus ( $\times 8$ ). 2B.—Tarsal claws ( $\times 75$ ).

Fig. 3.—*Ameletoides lacus-albinae*, n.g. et sp. Genitalia of male imago ( $\times 30$ ); *fb* forceps-basis, *fc* forceps, *pe* penis. Ventral view.

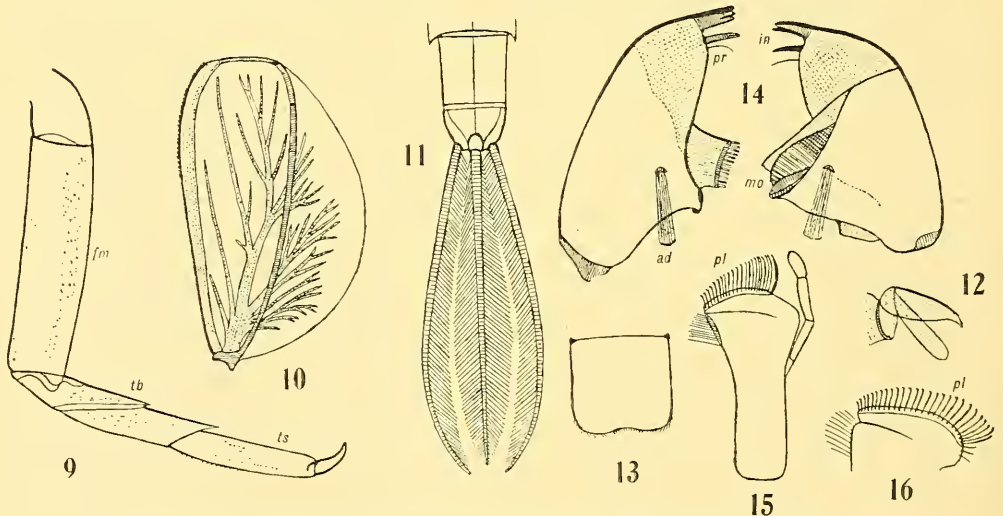
Fig. 4.—*Ameletoides lacus-albinae*, n.g. et sp. Nymph, nearly full-grown, lateral view ( $\times 6$ ).

Figs. 5-8.—*Ameletoides lacus-albinae*, n.g. et sp. Mouth-parts of nymph. 5.—Labrum ( $\times 30$ ); 6.—Mandibles ( $\times 30$ ); *ad* adductor muscle, *in* incisor, *mo* molar area, *pr* prostheca; 7.—Maxilla ( $\times 30$ ); 8.—Labium ( $\times 30$ ).

between the two runs a strong chitinous support, slightly curved and nearer the dorsal than the ventral edge; the gill thus appears to consist of a strongly supported ventral part between the stiff ventral margin and this support, with a free dorsal flange readily movable in a current of water; the ventral margin is finely toothed along its distal third. There is a single stout gill-trachea which branches in all directions in the gill, but has its finest branches in the dorsal flange. The colour of the gills is milk-white shading to pale grey. Cerci (fig. 11) stout, with short, annular segments and carrying a strong fringe of hairs on the inner margin; appendix dorsalis similar, almost as long, and carrying a fringe of hairs on either side.

*Types*.—Holotype male imago, allotype female imago, type male subimago and type female subimago all taken at Lake Albina, Mount Kosciusko, 6,350 ft., the first three on 2nd Feb., 1929, the last-named on 1st Feb., 1930. Type nymph and nymphal exuviae taken on rocks in the lake, 1st Feb., 1930. All the above in the Tillyard Collection, together with a paratype series of six imagos and two subimagos, pinned, and several in alcohol; also a series of nine slides with mounts of the most important imaginal and nymphal structures, from which the figures here given have been drawn.

This remarkable insect occurs, as far as is known, only on Lake Albina. I have searched for its nymph in the other lakes and streams on Mount Kosciusko, but have failed to find it there. The nymphs are confined to the waters of the lake itself and of two or three very short streams which enter it from the surrounding mountains. They may be seen either resting on the sandy bed, or



Figs. 9-11.—*Ameletoides lacus-albinae*, n.g. et sp. Parts of nymph. 9.—Hind leg ( $\times 16$ ); *fm* femur, *tb* tibia, *ts* tarsus; 10.—Fifth gill ( $\times 30$ ); 11.—End of abdomen and tail-filaments ( $\times 12$ ).

Figs. 12-16.—Details of *Ameletus* Eaton s. str. for comparison with *Ameletoides*, n.g., and *Nesameletus*, n.g. 12.—*Ameletus velox* Dodds (North America); tarsal claws of imago ( $\times 75$ ); 13.—*Ameletus ludens* Needham (North America); labrum of nymph ( $\times 30$ ); 14.—*Ameletus velox* Dodds; mandibles of nymph ( $\times 30$ ); 15.—*Ameletus ludens* Needham; maxilla of nymph ( $\times 30$ ); 16.—*Ameletus velox* Dodds; anterior part of maxilla, to show plankton-rake ( $\times 30$ ). Lettering as in fig. 6, except *pl* plankton-rake.

on rocks and stones. When approached with a net, they swim off quickly with a darting motion. They are best caught by using two nets, keeping one fixed, and gradually moving the other towards it, disturbing the sand and stones in the way; then the nymphs resting on those stones dart forward into the stationary net. The gills are either held stationary, or sometimes vibrate quite rapidly. Nymphal exuviae are not found floating on the water, but resting on the sides of rocks in the lake, an inch or two above water-level. Adults have always proved very scarce during my visits to the lake; occasionally males may be seen dancing in the air, but they appear mostly to prefer to rest on the shady side of large vertical rocks, where they are very watchful and not easy to catch. I have also taken specimens stuck on the snow which lies all the year round near the summit of the mountain, at about 7,000 ft.

There can be no doubt that this is the single remaining Australian representative of the group represented by the New Zealand genus *Nesameletus*, n.g. (previously *Ameletus* spp.). Both imagos and nymphs are closely similar in the two genera, and the mottled colouring of the subimagos is much the same in both. Only a few small but important characters serve to separate the two genera, which are really more closely related to one another than either of them is to *Ameletus*, s. str., a Holarctic genus.

In order to distinguish clearly the characters of these related forms, I propose to include in this paper a discussion of the New Zealand genus.

#### Genus NESAMELETUS, n.g.

This genus has been very fully defined by Phillips (1930, p. 311) under the name "Genus AMELETUS (New Zealand Type)". Some of the characters used by him appear to be not of generic value, notably the presence of a median dark band on the femur. I also think that Phillips is in error in defining the claws as "alike, narrow and hooked in each tarsus". This character also puzzled Eaton (1885, 1899), for he first of all placed the New Zealand species *ornatus* in *Chirotonetes* (claws alike), but later in *Ameletus* (claws dissimilar). The truth appears to me to be that the claws are distinctly dissimilar, but that the broadened claw is not as blunt as it is in the American and European species of the genus *Ameletus*.

The genus may be defined as being very close to *Ameletoides*, n.g., from which it differs only in the following points:

*Imago*.—Appendix dorsalis greatly reduced, 1 to 3 mm. long only; tarsal claws distinctly dissimilar, one very sharp, the other broad and more or less blunt, but not as markedly so as in *Ameletus*, s. str., or other genera of this family exclusive of *Isonychia*. Forewing with the triad of MP normal; hindwing markedly smaller than in *Ameletoides*, n.g.

*Nymph*.—In the mandibles, the large single incisor tooth is similar to that in *Ameletoides*, n.g., though not quite so truncated; but the prostheca is further removed from the incisor and consists of a short bristle accompanied by an inwardly-directed brush or feathered bristle more than twice as long. The other mouth-parts similar to those of *Ameletoides*, n.g., except that the lacinia of the maxilla is somewhat shorter and blunter. The tibia is not subdivided by an oblique groove; the tarsal claws are finely serrated on the inner margin. The gills are similar to those of *Ameletoides*, n.g. The appendix dorsalis is markedly shorter than the cerci.

Genotype, *Ameletus ornatus* Eaton, from New Zealand.

The genus contains a second species, *Nesameletus flavitinctus* (Till.), also from New Zealand.

A study of the genotype of the original genus *Ameletus* Eaton, *s. lat.* (*A. subnotatus* Eaton), and other closely related North American species (figs. 12-16) shows, without a shadow of doubt, that the Holarctic and New Zealand forms are not congeneric. The imagos of *Ameletus*, *s. str.*, are comparatively small insects with extremely weak venation (hence the generic name); the main veins are more or less transparent, the cross-veins practically invisible. The claws are markedly dissimilar, one being very broad but sharply pointed, the other narrow but extremely blunt and rounded at apex (fig. 12). The nymphs have somewhat the same appearance as those of *Nesameletus*, *n.g.*, and *Ameletoides*, *n.g.*, but differ in some very important characters. The labrum (fig. 13) is fully as long as wide; the mandibles (fig. 14) are not triangular, but have the incisor and molar areas sharply separated, making them very irregular in form; there are two very slender incisors instead of one large stout one; the maxillae (fig. 15) are of an entirely different form, with very slender palp and a broad inner lobe (combined galea and lacinia) widened out distally and carrying along its distal margin a "plankton-rake" (fig. 16, *pl*). In the North American species which I have examined, the gills are oval without any very clear tracheation, and the chitinous longitudinal support is missing.

Genus TASMANOPHLEBIA Tillyard. Figs. 17-30; Plate I, figs. 3-6.

*Tasmanophlebia* Tillyard, 1921, pp. 409-412, figs. 1 (male genitalia), 2 (venation); 1926, p. 62.

This interesting genus, which is the Australian representative of the New Zealand genus *Oniscigaster*, was proposed by me for the reception of a single Tasmanian species, *T. lacustris* Till., of which only the adults are known. Since then two species have been discovered on Mt. Kosciusko, and both adults and nymphs are now known. Nymphs of a third species also occur in the Upper Cotter River, F.C.T., but the adults have not yet been found. A study of the new material indicates that the original definition of the genus requires some slight emendation, and that excellent nymphal characters are also available for distinguishing it further from *Oniscigaster* and other Siphonuridae.

*Adult.*—Forewing with tornus at one-half of wing-length or even somewhat beyond; triad of MP normal, arising very close to the origin of that vein; bullae faintly indicated or absent. Hindwing about half as long as fore, or somewhat more, and very nearly as wide, the humeral angle well-developed, obtuse; triad of MP very small, distally placed. Venation strongly chitinized, inclusive of the anal veins; cross-veins abundant and fairly regularly placed. Forelegs of male imago nearly as long as forewing; those of female imago only half as long as forewing, or less. Tarsi of all legs, except forelegs of male, at first sight apparently only four-segmented, owing to the basal segment being more or less fused with the tibia; this fused first segment about as long as the tibia, and longer than any of the others. Tarsal claws of all legs strongly dissimilar, one sharply hooked and one broad and blunt, with rounded apex. Abdomen narrowly cylindrical, tapering posteriorly, without lateral dilatations on any of the segments. Only two tail-filaments present, the cerci longer than the abdomen, the appendix dorsalis reduced to a minute remnant.

*Nymph.*—Free-swimming, dorso-ventrally flattened, the thorax not humped; abdominal segments with median dorsal crest and lateral flanges having strongly

projecting posterior angles. Head small, hypognathous, with laterally placed eyes and short antennae; mandibles with two sharp incisors; maxillary and labial palpi three-segmented; hypopharynx bilobed. Abdomen tapering posteriorly; only four pairs of gills, carried dorsally upon the abdomen, one pair on each of segments 1-4, the first a pair of strongly chitinized lamellae forming an operculum to the other three, which fit under it owing to the shortening of the first four abdominal segments; tail-filaments somewhat more than half as long as the abdomen, the appendix dorsalis somewhat shorter and much less strongly built than the cerci.

Genotype, *Tasmanophlebia lacustris* Till. (Lake Lilla, 3,200 ft., Cradle Mountain, Tasmania).

This remarkable genus appears to be well represented in the lakes and streams at high altitudes, both on the mainland and in Tasmania. In some respect it is the most archaic type of Mayfly still existing, notably in the large size of the hindwing. It is fairly closely related to the New Zealand genus *Oniscigaster* McLach., from which it is to be distinguished by the narrow, cylindrical abdomen of the adults, without any lateral dilatations of the segments, by the generally smaller size and by the peculiar specialization of the gills in the nymph. Nymphs of *Oniscigaster* resemble those of *Tasmanophlebia* fairly closely in general form, and, like them, possess a dorsal crest and lateral flanges on the abdominal segments; but there are seven pairs of gills instead of four, and each gill consists of a fairly hard plate of broadly oval shape, carried dorsally, flat upon the abdomen.

*Key to the Species of the Genus Tasmanophlebia Till.*

Imagos.

1. Species of small size, forewing 10-12 mm. .... 2  
Species of larger size, forewing 13-16 mm. .... *T. lacus-coerulei*, n. sp.
2. Body dark brown; lobes of penis in male with terminal seta, forceps with four segments ..... *T. lacustris* Till.  
Body black; lobes of penis without seta, forceps with only three segments .....  
..... *T. nigrescens*, n. sp.

Subimagos.

1. Species of larger size (forewing 13-16 mm.) with the wings bicolorous; a narrow triangular strip along distal margin of forewing, bounded by an oblique line from middle of pterostigma to tornus, markedly darker than rest of wing; distal margin of hindwing also darker than the rest .... *T. lacus-coerulei*, n. sp.  
Species of smaller size (forewing 10-12 mm.) with the wings unicolorous or nearly so ..... 2
2. Body brown; wings greyish with a touch of brown at bases .... *T. lacustris* Till.  
Body blackish; wings also appearing black in life when folded, dark grey when spread out ..... *T. nigrescens*, n. sp.

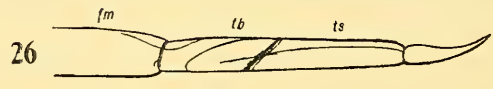
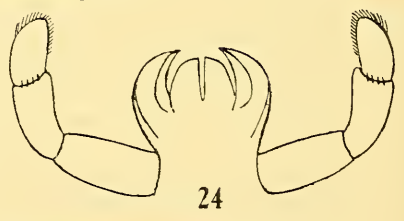
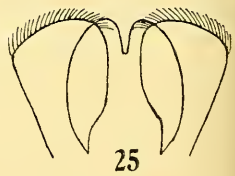
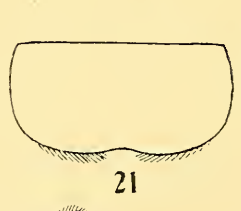
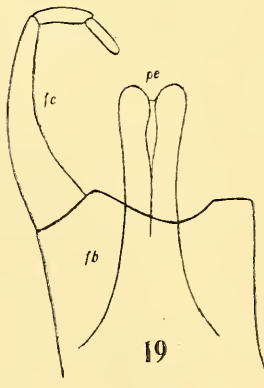
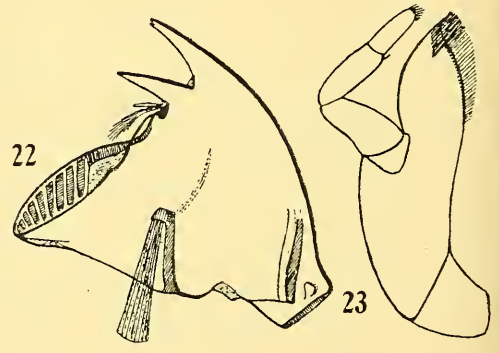
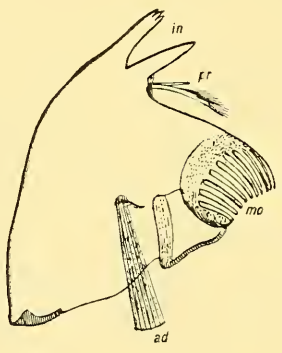
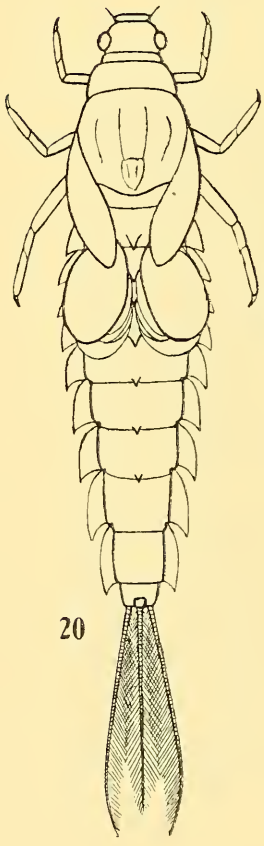
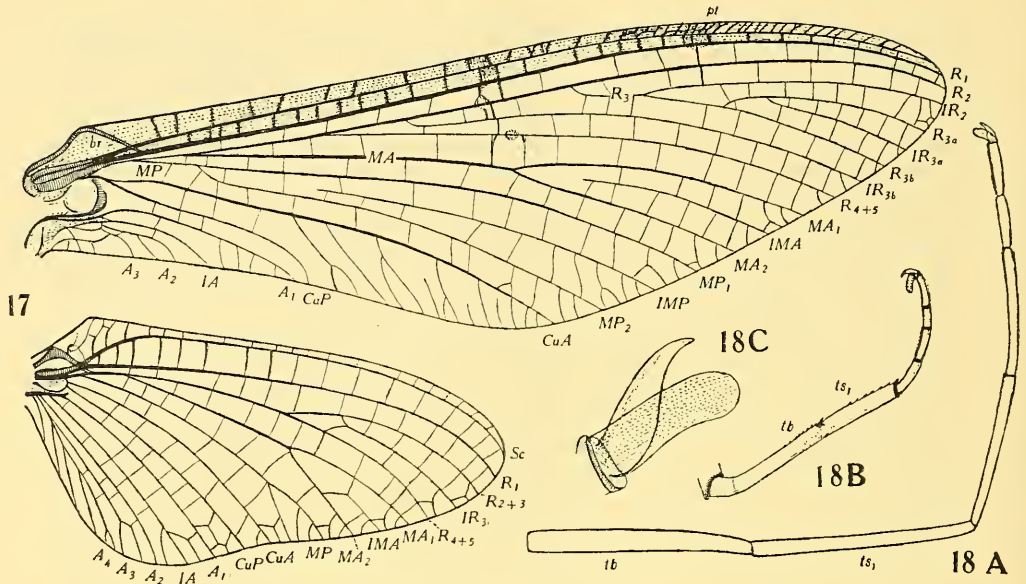
Nymphs.

1. Dorsal carina with large tooth-like projections on segments 1-5, not sharply pointed, those of segments 3-5 subequal and larger than those of segments 1-2 .....  
..... *T. nigrescens*, n. sp.
- Dorsal carina with large tooth-like projections on segments 1-2, sharply pointed; segment 3 with a much less elevated projection, also sharply pointed; segments 4-7 with flatter, posteriorly directed teeth progressively diminishing in size, that of segment 7 very small ..... *T. lacus-coerulei*, n. sp.

TASMANOPHLEBIA LACUS-COERULEI, n. sp. Figs. 17-27; Pl. i, figs. 3, 4.

*Imago*. Figs. 17-19.

♂ (dried): total length (excluding tail-filaments) 14 mm.; abdomen 9.5 mm.; forewing 13.5 mm.; hindwing 7 mm.; cerci 20 mm.; appendix dorsalis 0.3 mm.



Head small, dark brown; eyes (collapsed) black with reddish-brown rims; ocelli shining black; antennae dark brown, short, surrounded by an area of lighter brown.

Thorax deep shining brown above, inclining to black; sides with varying shades of brown; sternites pale brown; above the middle coxae and around the bases of the wings are patches of bright orange-red. Legs: forelegs 13 mm. long, blackish-brown; femur 3.5 mm., tibia 2.2 mm., tarsal segments in descending order of length 1, 2 = 3, 4, 5; middle and hind legs much shorter, about 7 mm., rather pale brownish in colour; the amount of fusion between tibia and metatarsus somewhat variable, tarsal segments in descending order of length 1, 2 = 3, 5, 4; tarsal claws (fig. 18c) markedly dissimilar, one very sharply hooked and one broad and blunt with well-rounded apex.

Wings brilliant, the membrane hyaline, the veins well-chitinized, including those of the anal area, and mostly brown in colour. First and second axillaries of forewing greyish with dark centres; third axillary, costal brace vein and basal portions of Sc and R up to brace, orange-brown. All costal and subcostal cross veins suffused with brown pigment; pterostigma right to apex suffused with brown from costa to radius and carrying numerous cross-veins linked in the middle portion into a double series by cross-bars. A faint bulla indicated about half-way along  $R_{2+3}$  by a minute brown cloud, with sometimes another below it on  $R_{4+5}$ ; hindwing usually entirely hyaline, but sometimes a tinge of yellow on membrane at base of both wings. Hindwing with posterior margin slightly concave or emarginate at end of CuA.

Abdomen: segment 1 as broad as thorax, to which it is closely applied, very dark brown; segments 2-9 medium brown with a dark brown pattern; on segments 2-4, a broad longitudinal dark band on dorsum, not clearly defined; on segments 5-9, two narrow longitudinal dark bands, separated by a paler stripe along the mid-dorsal line; segment 10 dark brown with paler rim; sides with indistinct dark brown bands; underside paler brown with darker blotches, paired on each segment. Genitalia as in Fig. 19, brown, the penis long, with lobes not prominent, close together, evenly rounded at apices; forceps-basis broad, the forceps with three segments only, the first being broad basally and very long, tapering distally, the second much shorter, cylindrical, the third narrower and somewhat shorter than the second, also cylindrical. Tail-filaments: cerci pale brown at extreme base, the rest medium brown, cylindrical, with about 45 not very clearly marked segments; appendix dorsalis a mere remnant, very short, with 4 to 5 short segments.

♀ (dried): total length 16 mm.; forewing 16 mm.; hindwing 8.4 mm.; cerci 19 mm.; appendix dorsalis 0.2 mm. Differs from the male in the smaller eyes, in

Fig. 17.—*Tasmanophlebia lacus-coerulei*, n. sp. Venation of male imago. Revised Notation, as in fig. 1. Length of forewing 13.5 mm.

Fig. 18.—*Tasmanophlebia lacus-coerulei*, n. sp. Legs of male imago. 18A.—Tibia and tarsus of foreleg ( $\times 8$ ). 18B.—Tibia and tarsus of hindleg ( $\times 8$ ). 18C.—Tarsal claws of foreleg ( $\times 75$ ). *tb* tibia, *ts* metatarsus.

Fig. 19.—*Tasmanophlebia lacus-coerulei*, n. sp. Genitalia of male imago ( $\times 30$ ). Lettering as in fig. 3. (Right forceps omitted.) Ventral view.

Fig. 20.—*Tasmanophlebia lacus-coerulei*, n. sp. Nymph, full-grown ( $\times 4$ ).

Figs. 21-26.—*Tasmanophlebia lacus-coerulei*, n. sp. Mouthparts and leg of nymph. 21.—Labrum ( $\times 30$ ); 22.—Mandibles ( $\times 30$ ), *ad* adductor muscle, *in* incisors, *mo* molar area, *pr* prostheca; 23.—Maxilla ( $\times 30$ ); 24.—Labium ( $\times 30$ ); 25.—Hypopharynx and paragnaths ( $\times 30$ ); 26.—Hindleg ( $\times 15$ ), *fm* distal end of femur, *tb* tibia, *ts* tarsus.

a slight tinge of olive on the thorax, in the shorter forelegs which are dark brown on the femora shading to a rich medium brown on tarsi, and in the large amount of faint pale yellowish suffusion on the wings; subanal plate bifid, with a triangular excision separating pointed lobes.

*Subimago.* Pl. i, figs. 3, 4.

In both sexes, the subimago is of somewhat darker body coloration than the imago; the forelegs of the male are only about half as long as the forewing. The wings are bicolorous; in the forewing, most of the membrane is pale grey, but the distal border is more darkly shaded, the dividing line running from about the middle of the pterostigma to the tornus; in the hindwing, the distal border is narrowly darkened all round. The effect is actually brought about only partly by a slightly deeper tinting of the distal membrane; it is chiefly due to the distal cross-veins being clouded with dark grey. In the forewing, the costal brace, basal parts of Sc and R up to the brace, and most of the axillaries are orange-brown, while the same colour tinges the pterostigma; from brace to pterostigma the costal and subcostal cross-veins are black. In the hindwing there is a touch of orange-brown at the base. In the female, the dark distal bordering of the wings is slightly wider and more pronounced than in the male.

*Nymph.* Figs. 20-27, 30A.

Total length (excluding tail-filaments) 19 mm. Cerci 7.5 mm.; appendix dorsalis 6.7 mm.

General form resembling the nymphs of the genus *Oniscigaster* McLach., but slightly narrower and more elongated; body dorso-ventrally flattened. Colour a dull fuscous above, without any marked pattern, shading to brownish beneath; the abdominal crests and flanges pale brownish, semitransparent.

Head small, somewhat transverse, with rather small eyes placed at the postero-lateral angles; antennae very short. Mouth-parts: Labrum (fig. 21) more than twice as wide as long, broadly rounded antero-laterally and slightly emarginate medially. Mandibles (fig. 22) very stout, with two sharp incisors, each either entire or slightly toothed distally; prostheca consisting of a strong bristle together with a longer process carrying a brush of hairs distally; molar area of right mandible very prominent, strongly angulate, provided with a large grid; that of the left mandible differently shaped, with a large comb and a hard grinding-plate; the comb carries about ten closely-set, slender prongs, slightly curved. Maxillae (fig. 23) with three-segmented palp, the basal segment the longest and broadest, subcylindrical, the second segment about two-thirds as long, somewhat narrower, with an inner apical bristle, the distal segment shorter still, distinctly narrower, cylindrical, with rather bluntly rounded apex carrying a number of short setae; inner lobe (combined galea and lacinia) rather broad, with outer margin strongly curved, distal portion of inner margin with abundant hairs and a shorter set of hairs placed distally between the two margins. Labium (fig. 24) with stout, three-segmented palps having their basal segments standing out transversely, second segment somewhat shorter, broadening distally, third segment short and fairly broad, well-rounded distally, hairy; paraglossae short, with outer margins greatly curved, apex pointed and turned inwards, slightly hairy; glossae slightly shorter than paraglossae, broad and fairly straight, very close together, somewhat truncate distally. Hypopharynx (fig. 25) oval, slightly longer than wide, deeply bifid medially; paragnaths (superlinguae) about the same length, broadened distally and carrying a fringe of incurving hairs on distal margin.



Thorax strongly built but not humped, the prothorax short but much wider than the head, the mesothorax about as long as wide, with a slight but definite colour-pattern dorsally; the metathorax very short; forewing-sheaths reaching back to overlap the bases of the gills. Legs (fig. 26) short, fairly close together, coxae and trochanters short, femora fairly long and stout, tibia and tarsus closely fused together with an oblique sutural line, the tibia markedly shorter than the tarsus; tarsal claw long and sharply pointed, smooth.

Abdomen markedly dorso-ventrally flattened, tapering gradually from segment 3 to posterior end. Segment 1 broader than thorax, segments 2-3 somewhat broader still, segment 4 slightly narrower than 3, the others decreasing markedly in width. Segment 1 about one-fourth as long as wide, about as long as segment 4; segments 2-3 very short. Lateral flanges present on segments 1-9, all sharply pointed posteriorly, as shown in fig. 30A. Dorsal crest (fig. 30A) with large nodding teeth on segments 1-2, a less prominent nodding tooth on segment 3, and with much flatter, posteriorly directed teeth diminishing in size from segments 4-7, that of segment 7 being very small. Gills (fig. 27), four pairs, on segments 1-4 inclusive, decreasing in size from first to fourth pair, and so inserted that the large first pair practically entirely cover the other three pairs, to which they form opercula; first pair (fig. 27A) broadly oval, strongly chitinized lamellae, with obsolescent tracheation; second pair (fig. 27B) similar in shape, but smaller, and with better developed tracheation; third pair (fig. 27C) smaller and shorter, lobed basally; fourth pair (fig. 27D) still smaller, lobed basally and having a large overfold. When examined *in situ* on the nymph, the gills appear to consist of four pairs lying dorsally upon the base of the abdomen and covered by the opercula, the apparent extra pair being actually the overfolds of the fourth (fig. 20). Colour of operculum dark brownish, of the other gills dull greyish. Cerci (fig. 20) stout, incurved distally, with short, annular segments carrying a strong fringe of hairs on the inner margin; appendix dorsalis paler and less strongly formed, somewhat shorter, with a fringe of hairs on either side.

*Types*.—Holotype male imago and type male subimago taken at Blue Lake, Mt. Kosciusko (6,200 ft.) on 1st Feb., 1930; allotype female imago and type female subimago in same locality on 28th Jan., 1929. Type nymph and nymphal exuviae taken on rocks in the lake, 28th Jan., 1929. All the above in the Tillyard Collection, together with a paratype series consisting of 28 imagos and 27 subimagos, all pinned, and nearly all females, and several in alcohol; also a series of fourteen slides with mounts of the most important imaginal and nymphal structures, from which the figures here given have been drawn.

So far, this very striking Mayfly has only been found in the Blue Lake, where the nymph may be seen resting on the large rocks and boulders which occur in it, or sometimes on the pebbly bottom. They are by no means easy to catch, as they readily slip away from the advancing net; however, when swimming freely, they are not at all fast. When about to emerge, they climb just out of the water on the steep rocks and boulders of the foreshore of the lake and transform there. Subimagos may be captured with comparative ease while resting on these boulders, while imagos may be found either drifting with the wind near the lake, or sometimes dancing in groups of two or three in the bright sunshine. Specimens have also been found stuck in the snow banks near the summit, at about 7,000 ft.

*TASMANOPHLEBIA NIGRESCENS*, n. sp. Figs. 28, 29, 30B; Pl. i, figs. 5, 6.

*Imago*. Figs. 28, 29.

♂ (dried): total length (excluding tail-filaments) 12 mm.; abdomen 8 mm.; forewing 10.5 mm.; hindwing 4.7 mm.; cerci long, broken; appendix dorsalis 0.15 mm.

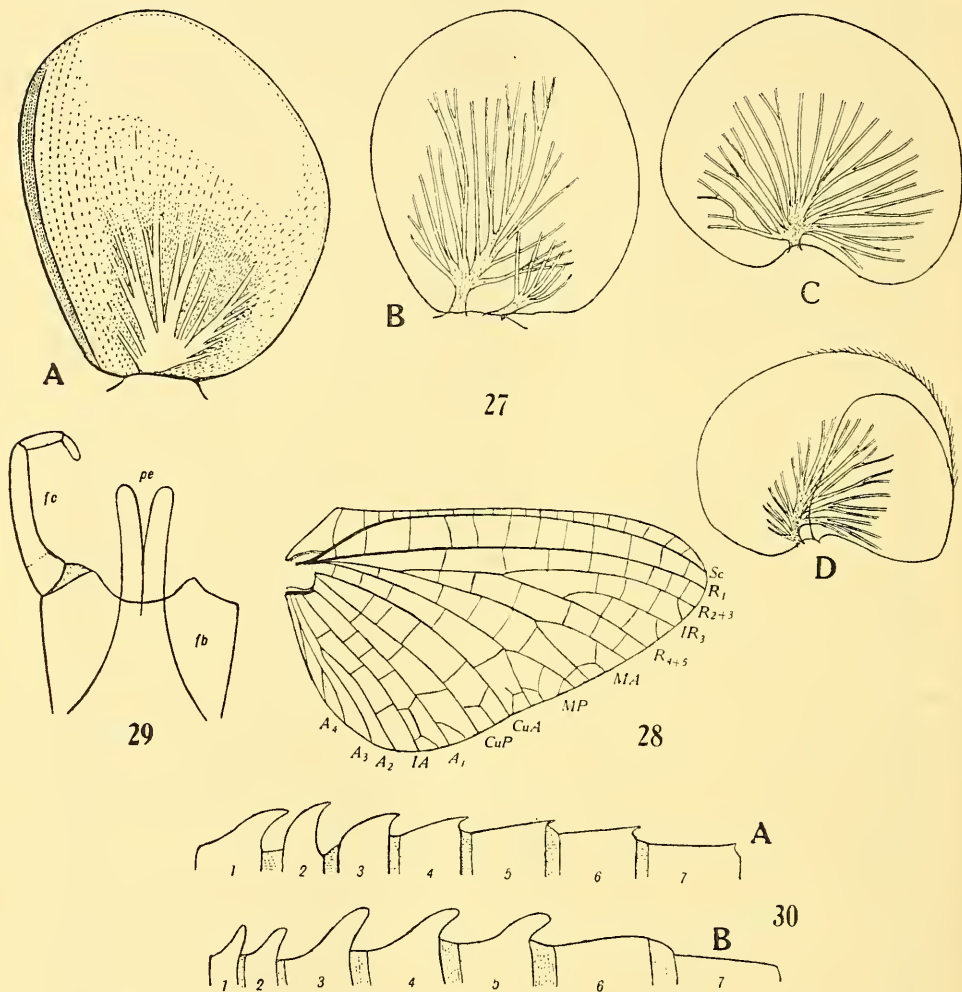


Fig. 27.—*Tasmanophlebia lacus-coerulei*, n. sp. Gills of nymph. A, first gill or operculum; B, second gill; C, third gill; D, fourth gill, showing overfold. All  $\times 15$ .

Fig. 28.—*Tasmanophlebia nigrescens*, n. sp. Hindwing of female imago. Length 4.7 mm. Revised Notation. Venation as in fig. 1.

Fig. 29.—*Tasmanophlebia nigrescens*, n. sp. Genitalia of male imago ( $\times 30$ ). fb forceps-basis, fc forceps, pe penis. (Right forceps omitted.) Ventral view.

Fig. 30.—Dorsal crests of nymphs of *Tasmanophlebia*. A.—*T. lacus-coerulei*, n. sp. B.—*T. nigrescens*, n. sp. 1-7, abdominal segments.

Head small, blackish; eyes (collapsed) blackish; ocelli pale brownish; antennae brown.

Thorax shining black, with a slight touch of rich dark brown above. Legs pale brownish, darker at the joints; forelegs 9 mm. long, tarsal segments in descending order of length 1, 2 = 3, 4, 5; middle and hind legs much shorter, about 3.5 mm., tarsal segments in descending order 1, 5, 2, 3, 4; tarsal claws markedly dissimilar, blackish.

Wings mostly hyaline, not brilliant, all the veins dark brown, well chitinized, including the anals of both wings. In the forewing, the pterostigmatic area carries numerous cross-veins, many of which are linked together by cross-bars to form an irregular double series; this area is more or less deeply tinted with transparent brownish; in one specimen, a rich brown tinge spreads basad along costal and subcostal spaces and obliquely across the base of the wing to form a brown cloud covering most of the anal area; third axillary orange-brown. Hindwing (fig. 28) hyaline, either tinged with brown near base, or with the brown tint more widely spread and reaching well along costa. Hindwing with posterior margin only very slightly emarginate at end of CuA.

Abdomen: segment 1 as broad as thorax, to which it is closely applied, black; rest of abdomen tapering posteriorly, blackish, without any definite pattern. Genitalia as in fig. 29, black, the penis moderately long, with lobes quite distinct and well rounded at apices; forceps-basis broad, the forceps with three segments only, of which the first is much the longest, the third shorter and narrower than the second. Tail-filaments: cerci pale brown with dark joints; appendix dorsalis a minute remnant.

♀ (dried): measurements of body and wings as in male; cerci 14 mm.; appendix dorsalis 0.25 mm. Differs from the male only in the small eyes, the much shorter forelegs, 3.5 mm. long, the stouter abdomen, and the wings entirely hyaline except for the brown tinge on the pterostigma and the orange-brown of the third axillary; subanal plate slightly excised medially.

*Subimago.* Pl. i, figs. 5, 6.

In both sexes, the subimago differs in life from the imago in having the wings, when folded together, appearing black. In the dried specimens, the wings are shaded deep grey, the membrane actually being pale grey and the veins clouded with dark grey. Viewed as a whole, the forewing shows a slight pattern suggesting an indistinct lunule, slightly paler than the rest, crossing the wing so that its outer and more distinct convex margin stretches from the beginning of the pterostigma across to the tornus. Also the basal portion of the wing is somewhat paler than the rest.

*Nymph.* Fig. 30B.

Total length (excluding tail-filaments) 14 to 16 mm. Cerci 5 to 6 mm.; appendix dorsalis slightly shorter.

General form the same as that of the previous species; colour-pattern a slightly mottled sandy brownish, with darker mid-longitudinal stripe along abdomen; this pattern gives some degree of protective colouring to the nymph as it rests on the sandy bottom of the stream. The mouth-parts differ only very slightly from those of the previous species. The principal difference between the two nymphs lies in the form of the dorsal crest (fig. 30B); in *T. nigrescens*, n. sp., the first five segments possess large nodding teeth, not very sharp, while segments 6-7 are devoid of armature. Gills much as in the previous species,

but not quite as broad; the opercula (first pair) more oval than in the previous species.

*Types*.—Holotype male imago taken at Spencer's Creek, Mount Kosciusko (5,700 ft.), 29th Jan., 1930; allotype female imago, type male subimago and type female subimago in same locality, 31st Jan., 1929. Type nymph and nymphal exuviae taken in same locality, 31st Jan., 1929. All the above in the Tillyard Collection, together with one paratype male imago, about fifty paratype female imagos and subimagos, and numerous nymphs and exuviae; also a series of five slides with mounts of the more important imaginal and nymphal structures, from which the figures have been drawn.

This species comes fairly close to the genotype, *T. lacustris* Till., from Lake Lilla, Cradle Mountain, Tasmania. It is about the same size, and appears to have very similar habits. It is, however, easily distinguished in life by the general black appearance of the subimagos; the male genitalia of the imagos are also very distinct and the hindwings are of somewhat different shape. The species occurs resting on the reeds bordering Spencer's Creek along the stretch just above the main road to the summit, not far from the new Bett's Camp. The creek here is sluggish and widens out in places, with reedy borders and very little movement of the water, so that the conditions approximate to those found along the sides of Lake Lilla. The nymphs can be seen resting on the sandy bottom of the creek, though their colouring is partly protective. They are very easily caught with a net. When emerging, they climb a few inches out of the water up a reed stem, and transform there. The subimago crawls up the stem and rests there, a conspicuous object. A very curious fact is that, out of more than fifty subimagos collected, only three were males. When kept on reeds in glass tubes, the subimagos transform on the second or third day, but many fail to effect the transformation without damage to the wings. Trout eat this species avidly; possibly the male subimagos fall victims to the trout through flying across the water more readily than the females.

Genus *COLOBURISCUS* Eaton. Figs. 31-45; Pl. i, figs. 7-10.

*Coloburus* Eaton, 1868, *Ent. Mo. Mag.*, v, p. 89 (genotype, *Palingenia humeralis* Walker 1853); Eaton, 1871, *Trans. Ent. Soc. London*, p. 132; Eaton, 1883-88, Revisional Monograph, pp. 201, 315.—*Coloburiscus* Eaton, 1883-88, Revisional Monograph, p. 308; Eaton, 1899, *Trans. Ent. Soc. London*, p. 290; Hutton, 1898, *Trans. N.Z. Inst.*, xxxi, p. 217; Hudson, 1904, *N.Z. Neuroptera*, p. 35; Tillyard, 1926, *Insects of Australia and N.Z.*, p. 62; Phillips, 1930, Revision *N.Z. Ephemeroptera*, Part I, *Trans. N.Z. Inst.*, lxi, p. 296; Phillips, 1931, *Studies of N.Z. Mayfly Nymphs*, *Trans. Ent. Soc. London*, lxxix, p. 414.

This is the only genus of Siphonuridae common to Australia and New Zealand, and is also undoubtedly the most highly specialized genus in the family, found in those countries. The genotype, *Coloburiscus humeralis* (Walker), is an extremely common species in most parts of New Zealand. The habits of the nymph, which clings to rocks in rapids and also has a protective resemblance to vegetable debris, have prevented this insect from falling too ready a prey to the introduced trout. The North and South Island forms appear to me to differ sufficiently for the former to deserve at least subspecific rank. In Australia, so far, only one species has been described, viz., *C. haleuticus* Eaton, from Victoria. Several other species are now known, but for the most part the material available is not sufficient for description. There is a second very

distinct species in Victoria, another in the F.C.T., and a third in the Queensland National Park, all from fairly high elevations. On Mount Kosciusko, two very fine species occur, which are described in this paper.

Phillips (1929) indicates that in New Zealand the presence of nymphs of *Coloburiscus* in a stream is a criterion of its excellence as a trout-stream. I think the same holds good for the mainland of Australia; if so, the number of first-class streams is much more limited.

*Adult*: Forewing with tornus at about two-fifths of wing-length from base; triad of MP arising close to the origin of that vein, with MP<sub>2</sub> much curved near its origin and approaching very close to CuA below it. Hindwing less than half as long as forewing, the humeral angle strongly developed; triad of MP small, distally placed. Venation strongly chitinized except at extreme base of wing and on basal portions of anal veins; cross-veins abundant and fairly regularly placed. Forelegs of male imago from two-thirds to nearly as long as the forewing; those of female much shorter. Tarsi of all legs five-segmented, shorter than the tibiae; tarsal claws of each leg strongly dissimilar, one sharply hooked and one blunt; those of forelegs of male sometimes hypertrophied. Abdomen tapering posteriorly, the first segment closely connected with the thorax; postero-lateral angles of ninth tergite produced into spines. Only two tail-filaments present, viz., the cerci, which are longer than the abdomen; the appendix dorsalis reduced to a mere remnant.

*Nymph*.—Sedentary type, clinging to rocks in rapid waters. Body somewhat S-shaped in lateral view, the thorax huge and strongly humped, the abdomen somewhat flattened dorso-ventrally, but without a dorsal crest. Head of medium size, hypognathous, with fairly large eyes, laterally placed, and antennae somewhat longer than the head; mandibles with two distinct incisors, strongly projecting molar area and a large brush of long hair on the upper surface; maxillary and labial palpi two-segmented, large; labrum, maxillae and labium very hairy; hypopharynx entire. Thorax very large and convex; legs rather short, spiny, the fore and middle femora also provided with long hairs; tarsal claws simple. Abdomen somewhat dorso-ventrally flattened, tapering posteriorly; gills carried upright dorsally upon the abdomen, one pair on each of segments 1-7 inclusive; each gill is deeply bifid and strongly spinose; tail-filaments three, the cerci well-developed, the appendix dorsalis variable.

Genotype, *Coloburiscus humeralis* (Walker), from New Zealand.

This peculiar genus is the most generally abundant Siphonurid type throughout New Zealand, while in Australia it is far more widely spread than any of the other genera. In both countries it is far more likely to withstand the attacks of the introduced trout than any other Siphonurid type, owing to the peculiar form and habits of the nymphs, which protect it to a large extent.

The genus is widely distributed on the mountain streams of south-eastern Australia, wherever the flow of water is permanent and there are rocky rapids suitable for the nymphs to inhabit. I have records of various species, still very imperfectly known, from Victoria right up to south-eastern Queensland. There is, however, so far no record from Tasmania, though one would expect the genus to occur there. Mount Kosciusko may certainly be claimed as the headquarters of the genus in Australia, since it is there that the nymphs are most abundant and the species largest. Indeed, one of the two species described here is the largest existing Mayfly known to me, with the sole exception of the giant Papuan Mayfly (*Plethogenesia papuana* Eaton), an insect of a very different build and appearance.

In the following key I have introduced the New Zealand species *C. humeralis* (Walker), in order to emphasize certain differences between the Australian forms and the genotype. These differences, however, do not appear to render the Australian forms deserving of even subgeneric rank.

*Key to the Species of the Genus Coloburiscus Eaton.*

Imagos.

1. Medium-sized species, the forewing not more than 15 mm. .... 2  
Larger species, the forewing from 17 mm. up to 25 mm. .... 3
2. Forewing with a yellowish patch at base ..... *C. humeralis* (Walker), N.Z.  
Forewing without any yellowish patch ..... *C. haleuticus* Eaton.
3. Very large species (forewing of male about 20 mm. long, of female up to 25 mm.)  
with costal margin of forewing marked by a rich brown band .....  
..... *C. giganteus*, n. sp.  
Species of somewhat smaller size (forewing of male 17 mm., that of female up to  
22 mm.), the costal margin hyaline or only tinged with brown along the  
pterostigma ..... *C. munionga*, n. sp.

Subimagos.

1. Medium-sized species, with a yellowish patch at base of forewing .....  
..... *C. humeralis* (Walker), N.Z.  
Larger species, without any yellowish patch ..... 2
2. Wings evenly suffused with opaque pale grey tint, the costal margin very faintly  
to moderately tinged with brown ..... *C. giganteus*, n. sp.  
Wings mottled grey, the membrane very pale, the individual veins clouded with  
medium grey; a small, irregular, clear space just beyond middle of forewing;  
costal margin without any tinge of brown ..... *C. munionga*, n. sp.  
(N.B.—The subimago of *C. haleuticus* Eaton is not known.)

Nymphs.

1. Appendix dorsalis less than half as long as the cerci; gills without any fibrils at  
base ..... *C. humeralis* (Walker), N.Z.  
Appendix dorsalis almost or quite as long as the cerci; gills with a large tuft of  
fibrils springing from base ..... 2
2. Very robust nymph of dark brown colour, with comparatively broad abdomen and  
heavily-spined legs ..... *C. giganteus*, n. sp.  
Less robust nymph of a paler brown colour, with the legs less heavily spined  
..... *C. munionga*, n. sp.  
(N.B.—The nymph of *C. haleuticus* Eaton is not known.)

*COLOBURISCUS HALEUTICUS* Eaton. Fig. 31.

*Coloburus haleuticus* Eaton, 1871, *Trans. Ent. Soc. London*, p. 133, Pl. vi, figs. 7, 7a; Eaton, 1883-88, Revisional Monograph, p. 203, Pl. xviii, fig. 32c (penis), Pl. xix, fig. 32 (forewing).

This species was described from a male imago taken in Victoria, "probably near Melbourne (McCoy)". There is little to go on in the description, which is compressed into seven lines. The best characters appear to be that the forewing is without any brown coloration along the costal margin and the penis is of rather peculiar shape (fig. 31). Unfortunately the hindwing is not figured or described.

I have not seen the type, which is probably in the Eaton Collection.

*COLOBURISCUS GIGANTEUS*, n. sp. Figs. 32-45; Pl. i, figs. 7, 8.

*Imago.* Figs. 32-34.

♂ (dried); total length (excluding tail-filaments) 16.5 mm.; abdomen 11.5 mm.; forewing 20 mm.; hindwing 8 mm.; cerci 23 mm.; appendix dorsalis 0.3 mm.

Head moderate, as wide as prothorax, blackish; eyes (collapsed) very large, black with pale rims; ocelli pale amber, set in black; antennae very short, brown.

Thorax medium shining brown above, slightly mottled, the mesonotum projecting strongly backwards as a median cornute process; sides and underside

rich shining brown, with paler mottlings. Legs: forelegs 12.5 mm. long, brown, the joints marked with black, the last tarsal segment mostly black; femur 3 mm., tibia 4.2 mm., tarsal segments in descending order of length 1 = 2, 3, 4 = 5; middle and hind legs much shorter, the middle about 7 mm., the hind about 9 mm., both pale, semi-transparent brownish, with black knees and touches of black at the ends of the tarsal segments and along upper side of last tarsal segment and claws; all the tarsal segments short, the complete tarsus considerably shorter than the tibia; claws small, markedly dissimilar, the sharp claw with a delicate tooth on inner margin; claws of foreleg hypertrophied into a broadly rounded, dark process (fig. 33A).

Wings brilliant, the membrane hyaline, the veins well-chitinized except at the extreme base of the main veins of the forewing from Rs to CuP as well as the anals. Forewing (fig. 32) with tornus at two-fifths of wing-length from base; MP<sub>2</sub> arising close to base, either at or before the first cross-vein above it, and curving so as to run much closer to CuA than to IMP. Pterostigma long, with a complete double row of cellules, the connecting cross-bars forming very nearly a complete line without any zigzagging. Costal and subcostal spaces entirely suffused with brown, this colour deepening distally; third axillary brown, with a suffusion of paler orange-brown posteriorly. Very small, faint bullae about half-way along R<sub>2+3</sub> and R<sub>4+5</sub>. Hindwing (fig. 32) entirely hyaline, fairly well rounded, the humeral angle very prominent, the costa straight from this angle to beyond half-way; costal cross-veins numerous, especially in basal half; anal veins moderately well chitinized.

Abdomen: segments 1-2 very short, as broad as the thorax; segment 1 closely affixed to thorax, medium brownish; segment 2 dark brown. Abdomen tapering from segment 3 to end; each segment from 3 to 8 inclusive dark brown above, with a pattern consisting of two round spots of paler brown placed anteriorly and a slightly larger similar blotch in the middle line posteriorly; the two anterior spots are clearly marked on segments 3-6, but become indistinct on 7 and 8; on the other hand, the posterior spot becomes more distinct on the more distal segments. Segment 9 dark brown, with ill-defined paler areas; its postero-lateral angles carrying a sharp, backwardly projecting spine about two-thirds as long as segment 10. Segment 10 itself mostly pale brown, darker on sides, and with two small dark points placed antero-dorsally. Underside a much paler brown. Genitalia as in fig. 34, mostly pale brownish, but distal part of forceps blackish; the penis short, appearing in the dried specimen as a broadly rounded lobe not reaching as far as the distal margins of the forceps-basis; after treatment with KOH, the two short lobes can be seen, each subdivided into three incurving branches, of which the most distal pair are crenulate on their outer margins; forceps-basis divided into two halves, fairly broad, with rather prominent inner distal angles; forceps three-segmented, the first segment much longer than the other two combined, bent basally, then straight and cylindrical; the second segment little more than one-third as long, narrower, also cylindrical; the third segment shorter and narrower, very narrowly oval in shape. Tail-filaments: cerci very long, stout basally, tapering to a fine thread distally, with from 60 to 70 segments (the distal ones indistinct); colour rich brown, with blackish rings at the joints; appendix dorsalis a minute, slender remnant consisting of 5-6 microscopic segments.

♀ (dried): total length 17 mm.; forewing 23.5 mm.; hindwing 9 mm.; cerci 20 mm.; appendix dorsalis 0.6 mm. Differs from the male in its considerably larger size, smaller eyes, larger ocelli, shorter forelegs (about 10 mm. long)

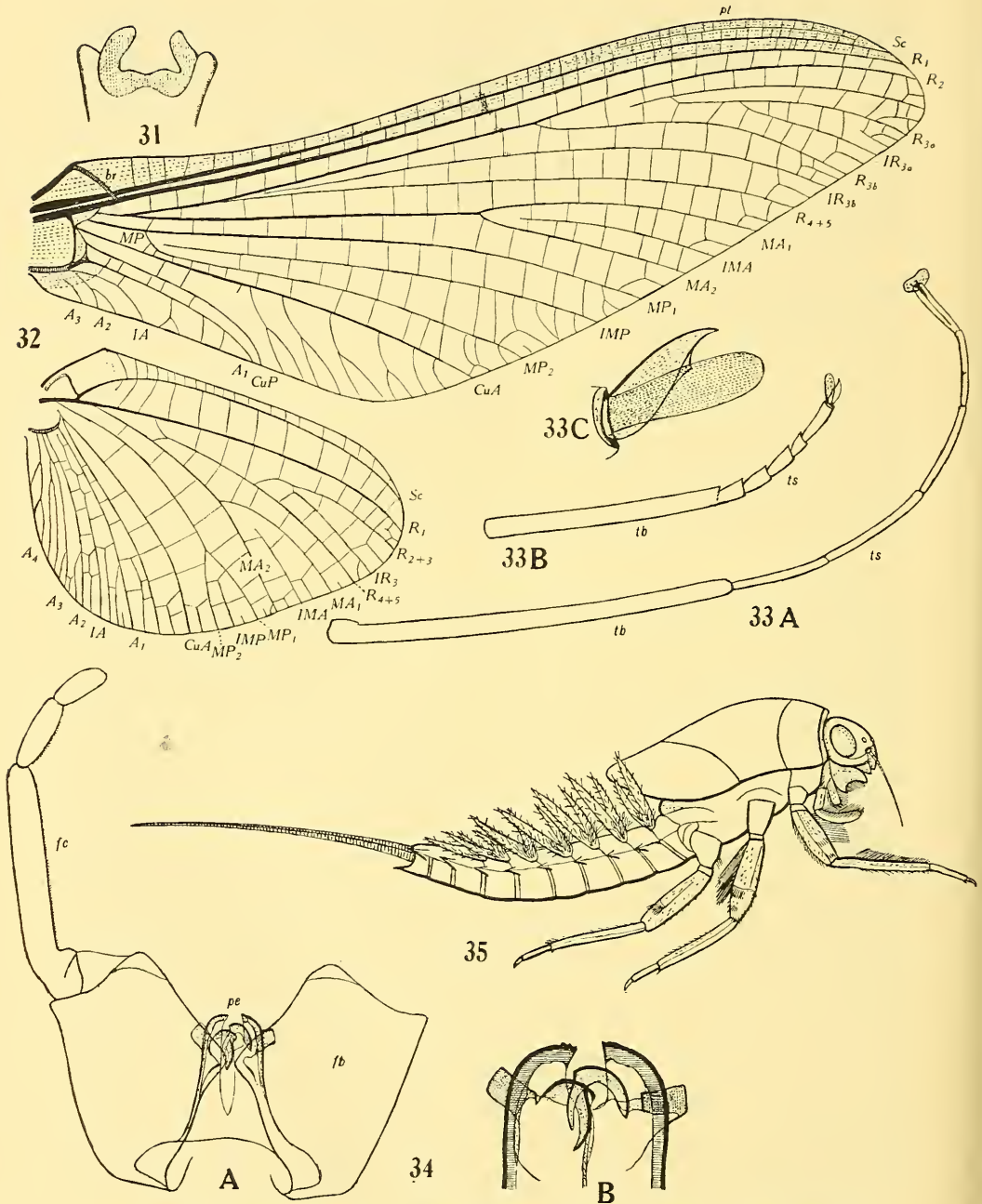


Fig. 31.—*Coloburiscus halcuticus* Eaton. Lobes of penis. After Eaton.  
 Fig. 32.—*Coloburiscus giganteus*, n. sp. Venation of male imago. Revised Notation, as in fig. 1. Length of forewing 20 mm.



with normal claws, and much wider and more cylindrical abdomen. The broad vertex between the eyes is brownish edged with a black line and, externally to this, with a fairly wide rim of orange-brown around the eyes. The thoracic nota are slightly paler than in the male. Except for segment 1, which is coloured like the thorax, the abdomen is darker and without any marked pattern, except that the sutures are pale. The postero-lateral spines of segment 9 are shorter and wider, being only about half as long as segment 10. Subanal plate hollowed out semicircularly on its distal margin, strongly bifid, with pointed lobes. Cerci slenderer than in male, with only 35-40 segments.

*Subimago.* Pl. i, figs. 7, 8.

In both sexes, the brownish coloration of the imago is replaced by a much duller greyish-brown, but the patterns remain the same; the forelegs of the male are only half as long as the forewing. The wings are opaque, uniformly shaded in pale greyish, without any trace of pattern, except that the costal and subcostal spaces are more darkly shaded in greyish-brown. The cerci are much shorter in the male, slightly shorter in the female. The postero-lateral spines in both sexes reach to the end of segment 10 or slightly beyond.

The largest specimen of the series is the type female subimago, which expands 50 mm. or just on two inches.

*Nymph.* Figs. 35-43.

Total length (excluding tail-filaments) 17 to 20 mm. Cerci 10 to 11 mm., appendix dorsalis almost or quite as long as cerci.

General form rather stout and heavily built, the outline of the body viewed laterally being somewhat S-shaped owing to the robust, strongly humped thorax and the rather dorso-ventrally flattened abdomen, without dorsal crest. Colour dark fuscous above, shading to medium brown on sides and paler brown beneath; eyes black with pale rims; legs medium brown, the distal ends of the femora and tibiae darker, spines dark brown; tail-filaments dark fuscous basally, shading to medium brown distally. Gills medium brown with somewhat darker spines. No definite colour-pattern present.

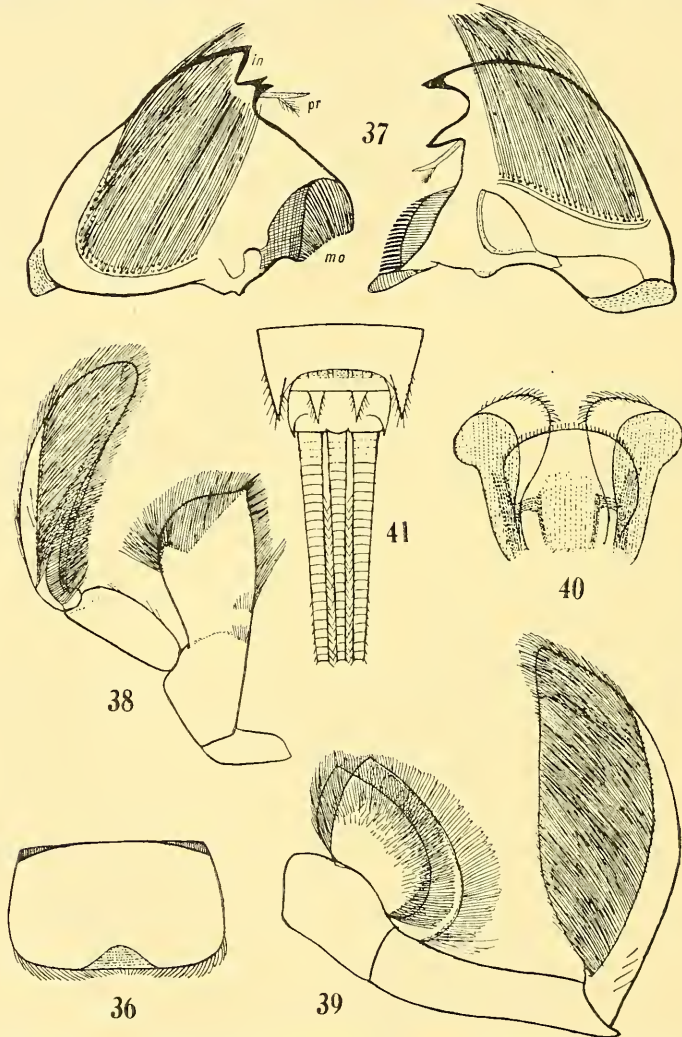
Head moderately large, strongly depressed, very convex dorsally and furnished with a fringe of hairs anteriorly; eyes lateral, fairly large; antennae slender, about 3 mm. long, brownish, composed of numerous short, ring-like segments. Mouth parts: labrum (fig. 36) about twice as wide as long, very hairy all over, broadly rounded antero-laterally and very slightly emarginate medially, with a dark triangular patch in middle of anterior margin. Mandibles (fig. 37) very stout, with two sharp incisors, each having its apex subdivided into three fine teeth and each carrying, on its outer surface, a series of about thirty long, slender hairs arising from the curved edge of a large shallow depression, and almost covering the whole mandible, together with a smaller brush of shorter hairs situated externally to the two incisors; right and left mandibles markedly

Fig. 33.—*Coloburiscus giganteus*, n. sp. Legs of male imago. A.—Tibia and tarsus of foreleg, showing hypertrophied claws ( $\times 8$ ). B.—Tibia and tarsus of hindleg ( $\times 8$ ). C.—Tarsal claws of hindleg ( $\times 75$ ). *tb* tibia, *ts* tarsus.

Fig. 34.—*Coloburiscus giganteus*, n. sp. A.—Genitalia of male imago ( $\times 23$ ), ventral view, with right forceps omitted; *fb* forceps-basis, *fc* forceps, *pe* penis. B.—Lobes of penis, further enlarged ( $\times 45$ ).

Fig. 35.—*Coloburiscus giganteus*, n. sp. Nymph, full-grown, lateral view ( $\times 4$ ).

different in shape, the right one having the outer margin strongly curved, the outer incisor strongly hooked, the inner incisor about as large as the outer but not curved, the inner margin between this incisor and the molar area strongly gouged out, and the molar area itself extremely prominent, wedge-shaped, with well-developed grinding plates; no prostheca visible; the left mandible, on the other hand, has the outer margin straighter, bluntly truncate before the outer incisor, which is strongly hooked and considerably larger than the inner; the



Figs. 36-41.—*Coloburiscus giganteus*, n. sp. Mouth-parts and end of abdomen of nymph. 36.—Labrum ( $\times 23$ ); 37.—Mandibles ( $\times 23$ ), *in* incisors, *mo* molar area, *pr* prostheca; 38.—Maxilla ( $\times 23$ ); 39.—Labium ( $\times 23$ ); inside view of left half only; the other half is held parallel, with the thick brushes of hairs in contact with one another; 40.—Hypopharynx and paragnaths ( $\times 23$ ); 41.—End of abdomen and tail-filaments (part only), ventral view ( $\times 8$ ).

prostheca slender, longer than the incisor, with shorter pencil of inwardly directed hairs; the margin between inner incisor and molar area perfectly straight, the molar area itself at right angles to it, carrying a comb of closely-set, slender prongs, fourteen or fifteen in number. Maxillae (fig. 38) with palps only two-segmented, the basal segment rather short, smooth, the distal more than twice as long, broader, sabre-shaped and very hairy; there is an indication from a slight obliquely placed line near the base of this segment, bordered on one side with hairs, that it actually consists of the two original distal segments fused together; inner lobes (combined galea and lacinia) broad, cultriform, with a sharp tooth at the inner distal angle; distal margin very hairy, inner margin with a close-set, regular row of shorter hairs. Labium (fig. 39) with large, two-segmented palpi, the basal segments smooth, long and fairly narrow, standing out transversely or even directed somewhat backwards, the distal segments even longer, sabre-shaped, very hairy, directed forwards; glossae and paraglossae overlapping on each side, both broadly cultriform with bluntly rounded apices, both hairy, the paraglossae more so than the glossae. Maxillae and labium held projecting forwards in parallel vertical planes; the two halves of the labium (fig. 39) parallel and close together, the angles of the palps projecting backwards between the bases of the forelegs. Hypopharynx a small, weakly chitinized, broadly rounded lobe, almost transparent, the paragnathis also rounded, not so broad, slightly hairy.

Thorax very stout, strongly convex above, the thoracic nota forming a kind of hard carapace, almost black in colour, the pronotum being marked off by an impressed transverse line, its length being about equal to that of the head viewed from above; the broad, subtriangular forewing-sheaths are continuous with the carapace and reach to between the second pair of gills. Legs (fig. 42) fairly large and stout, approximately equal in length; foreleg with the femur broader and shorter than in the other two, the tibia longer and more curved and swollen near its base; the fore and middle femora carry a fringe of long hairs on a little more than the basal half of the ventral margin, while the anterior surface carries numerous small spines irregularly arranged, together with two transverse half-rows of spines, of which the ventral half-row is placed distally from the dorsal; the hind femora are spiny but not hairy; fore tibiae slightly curved and widened basally, very spiny, with a long fringe of hairs on all but the extreme base of the ventral margin; middle and hind tibiae very spiny, without hairs; all tarsi short, about half as long as middle or hind tibia, smooth except for a few minute setae at distal end; tarsal claws smooth, strongly hooked, fully one-third as long as tarsi.

Abdomen stout, fairly broad, strongly tapering posteriorly, somewhat dorso-ventrally flattened, without any dorsal crest; postero-lateral angles of segments 2-9 ending in a sharp spine, gradually increasing in size from 2 to 9; the larger of these spines themselves carry a few small setae or spinules. Gills (fig. 43) on segments 1 to 7 inclusive, one pair on each segment; all seven pairs large and fairly equal in size, those of segments 1 and 7 a little smaller than the others; each gill consists of a hardened chitinous process, deeply bifid, with two sharply pointed prongs, both densely spined; from near the base of the gill, on the posterior side, there arises a large tuft of delicate, greyish-white fibrils. Tail-filaments (fig. 41) stout basally, tapering distally, straight, very slightly hairy, held close together, diverging slightly distally; all three about the same length.

*Types*.—Holotype male imago, allotype female imago, and type male and female subimagos, all taken on Diggers' Creek, Mount Kosciusko (5,000 ft.), on 30th Jan., 1930. Type nymph and nymphal exuviae taken under rocks in the same locality, on the same day. All the above in the Tillyard Collection, together

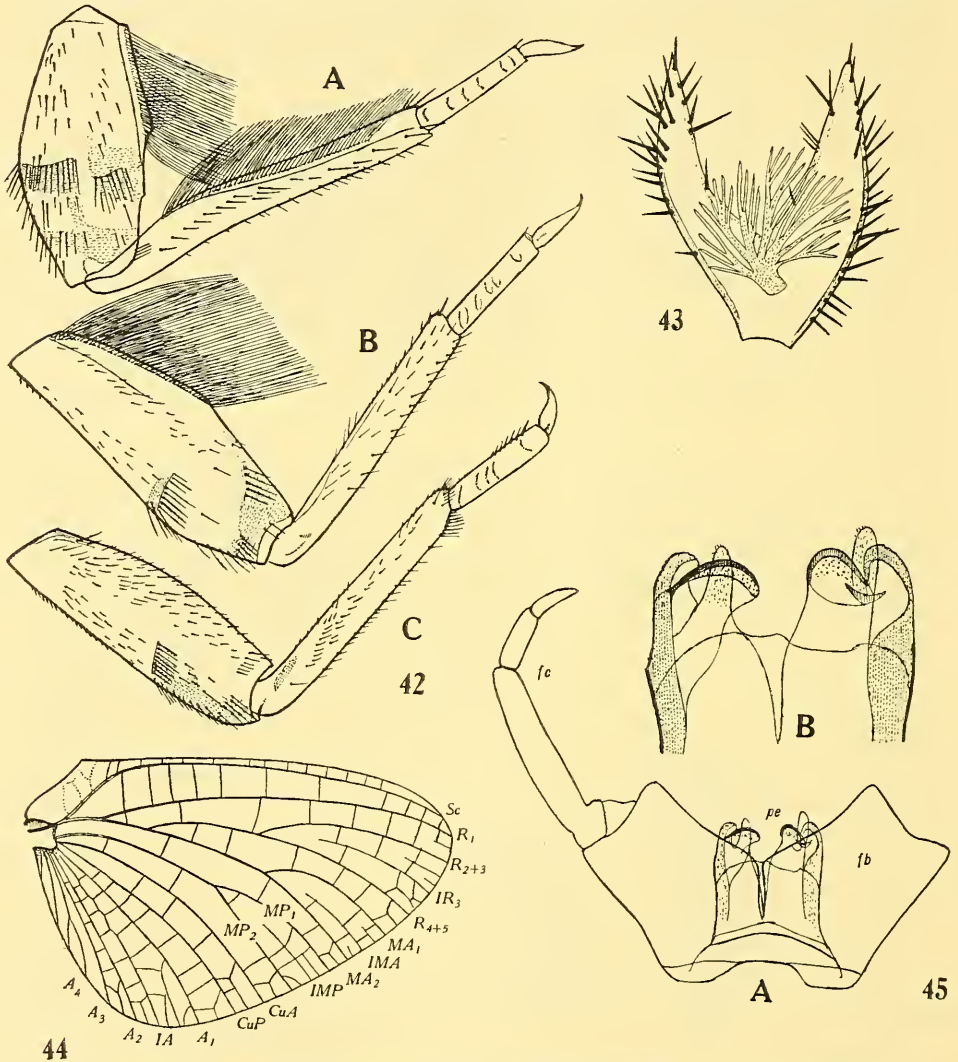


Fig. 42.—*Coloburiscus giganteus*, n. sp. Legs of nymph ( $\times 12$ ). A, foreleg; B, middle leg; C, hindleg.

Fig. 43.—*Coloburiscus giganteus*, n. sp. Nymph, fifth gill ( $\times 16$ ).

Fig. 44.—*Coloburiscus munionga*, n. sp. Hindwing of male imago. Length 7.5 mm. Revised Notation. Venation as in fig. 1.

Fig. 45.—*Coloburiscus munionga*, n. sp. A.—Genitalia of male imago ( $\times 23$ ), ventral view, with right forceps omitted,  $fb$  forceps-basis,  $fc$  forceps,  $pe$  penis. B.—Lobes of penis, further enlarged ( $\times 45$ ).

with a series of eight paratype subimagos and sixteen paratype imagos, also a number of nymphs, all from the same locality, 25th Jan. to 2nd Feb., 1930; also a series of seven slides with mounts of the most important imaginal and nymphal structures, from which the figures here given have been drawn.

This magnificent Mayfly is only to be taken towards the end of January or beginning of February on Diggers' Creek and other similarly rapid, rocky creeks on Mount Kosciusko. The nymphs cluster in small colonies under rocks in the swiftest parts of the stream. They were first found by me in 1905; but it was not until 1930 that I saw the first subimago, resting on the edge of a rock, close to the rushing water, at sundown. At the end of about half an hour or less the subimago rises suddenly into the air at an angle of about forty-five degrees, passing right out of sight, unless, as often happens, a bird seizes it. All my subimagos were gathered from the rocks either near sunset or sunrise, and all the imagos were reared from them, the average duration of subimaginal life being two and a half days.

*COLOBURISCUS MUNIONGA*,\* n. sp. Figs. 44, 45; Pl. i, figs. 9, 10.

*Imago*. Figs. 44, 45.

♂ (dried): total length (excluding tail-filaments) 16 mm.; abdomen 9 mm.; forewing 17.5 mm.; hindwing 7.5 mm.; cerci about 20 mm.; appendix dorsalis minute, slender, about 0.2 mm.

Head moderate, about as wide as prothorax, blackish; eyes (collapsed) large, blackish; ocelli silvery, set on blackish prominences; antennae short, dark brown; frons medium brown.

Thorax shining brown, the anterior and posterior processes of the mesonotum pale brownish, with a dark median stripe between them, bordered on either side by a pale stripe, and these externally by dark stripes; the two postero-lateral bosses of the mesonotum orange-brown, shading to dark brown near the wings; sides brown with paler spiracles; sterna rich brown. Legs: forelegs 12 mm. long, the femur brown touched with blackish, the tibia blackish, the tarsus brown with blackish joints; the tarsus about as long as the tibia; tarsal segments in descending order of length, 1 = 2, 3, 4 = 5; middle and hind legs shorter, the hind about 9 mm., pale semi-transparent brownish, with darker knees and touches of dark at ends of the tibiae and the tarsal segments; the tarsus little more than half as long as the tibia; tarsal claws very small, blackish, markedly dissimilar.

Wings brilliant, the membrane entirely hyaline except for a faint tinge of brown on the pterostigma of the forewing. Forewing with tornus at about two-fifths from base; venation similar to that of previous species, pterostigma with a complete double row of cellules; third axillary narrowly dark brown, with a greyish area posteriorly. Hindwing (fig. 44) much as in previous species, with very prominent humeral angle and straight costa to beyond half-way, entirely hyaline with dark axillaries.

Abdomen shaped much as in previous species, colour fairly dark brown, with a pattern consisting of paler brown areas, arranged much as in previous species, but larger and, on the whole, not quite as well defined; from segment 3 backwards there runs a fairly well-marked median longitudinal stripe of dark brown, divided along the middle by a fine pale line; postero-lateral spines of segment 9 about as long as segment 10, very pale; segment 10 dark brown, bordered

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\* *Munionga*: the aboriginal name for the Mount Kosciusko Range.

posteriorly with pale brown; underside pale brownish, same colour as hind legs. Genitalia as in fig. 45, mostly pale brownish, the penis somewhat darker; in the dried specimens the penis is seen as a short, very stout process below and between the cerci; after treatment with KOH, it is seen to have each lobe subdivided into three processes, as in the previous species, but these processes are very different in shape, two being broadly rounded and one rather slender, while none of them is as incurved as those of the previous species; the outer margins of the innermost pair of processes are barely crenulate and are minutely punctate on the semi-transparent membrane just behind the strongly chitinized outer border; forceps-basis divided into two halves, shaped much as in previous species but not so large; forceps three-segmented, shaped much as in previous species, but the short distal segment narrower and less rounded apically. Tail-filaments: cerci with about 60 segments, brown ringed with blackish at joints, not so stout as in previous species; appendix dorsalis a minute remnant with a few indistinct segments carrying tiny setae.

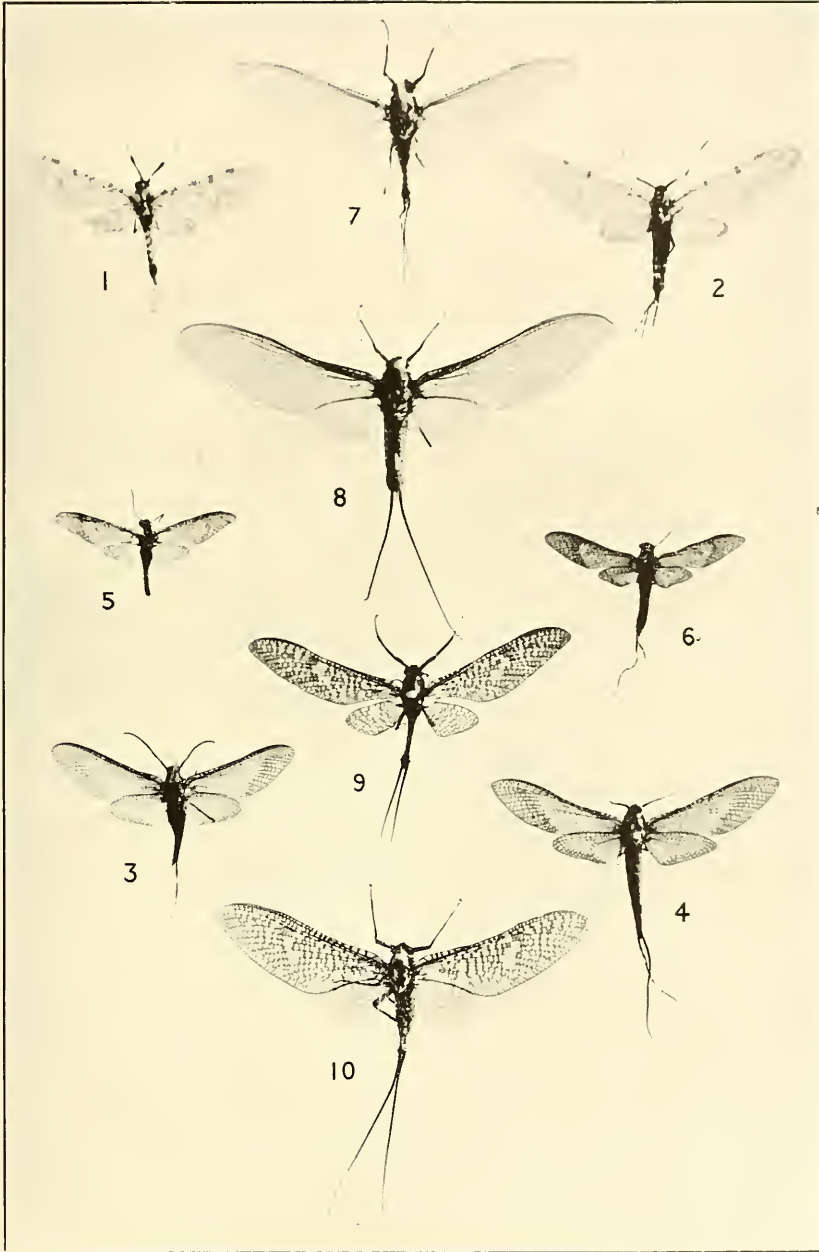
♀ (dried): total length 15 mm.; forewing 21 mm., hindwing 8 mm.; cerci 28 mm.; appendix dorsalis 0.2 mm. Differs from the male in its larger size, smaller eyes, larger and much darker ocelli, shorter forelegs (9 mm. long) and much wider and more cylindrical abdomen. The colouring of the vertex is similar to that of the preceding species, but with a pale line dividing it longitudinally. Colouring of thorax much as in the male. Abdomen with segments 1-2 medium brown, segments 3-10 very dark brown with the posterior margins of segments 3-7 bordered by a transverse band of medium brown carrying, on either side of the middle line, either two or three triangular patches of pale brown with their apices projecting forwards; on segments 8-9 the pattern is indistinct, while segment 10 is dark brown with a pale posterior edge; postero-lateral spines of segment 9 shorter and wider than in male, about two-thirds as long as segment 10, pale in colour; subanal plate deeply hollowed out. Cerci stouter and longer than in the male, with more than 100 short segments, becoming indistinct distally.

*Subimago.* Pl. i, figs. 9, 10.

In both sexes the brownish colouring of the imago is replaced by a duller greyish-brown, but the colouring of the male subimago is closer to that of the imago than in the female; the patterns in each sex remain very much the same. The wings are mottled in pale and fairly dark grey, a marked pattern being formed by the darkly shaded cross-veins on a membrane of very pale semi-opaque greyish; each cross-vein is itself black, enclosed in a darkened area from one-third to one-half as wide as long. In forewing, around the curved basal portion of  $R_2$ , several cross-veins have these dark areas fused together into a single patch; below and somewhat anterior to this is a large pale patch of irregular shape devoid of cross-veins and somewhat suggesting a lunule; hindwing with the dark patches surrounding the cross-veins very narrow. Postero-lateral spines of segment 9 of abdomen much as in imagos. Cerci 14 mm. in male, 23 mm. in female.

*Nymph.*

None of the nymphs which appear to belong to this species is full-fed, and therefore I hesitate to offer characters for distinguishing it from those of the previous species. The nymphs generally are of a much paler brown colour, somewhat less robust build, with slightly narrower thorax and more cylindrical



Subimagos of the family Siphonuridae.

abdomen, the legs and gills less spiny. Mouth-parts closely resembling those of previous species. How far the differences noted are due to immaturity I am not able to say.

*Types*.—Holotype male imago taken at Diggers' Creek, below waterfall (about 4,000 ft.), Mount Kosciusko, 12th Dec., 1931; allotype female imago and type female subimago, both taken on Diggers' Creek at 5,000 feet. on 11th Dec., 1931; type male subimago taken on Spencer's Creek (5,700 ft.), 31st Jan., 1929. Type nymph (two-thirds grown) taken on rocks in Spencer's Creek, 31st Jan., 1929. All the above in the Tillyard Collection, together with four paratype imagos and three paratype subimagos and a few nymphs; also a slide showing male genitalia prepared from one paratype.

This species was originally discovered by me on Spencer's Creek at the 5,700 ft. level at the end of January, 1929, when two subimagos were taken and a single imago was found damaged and floating down-stream. In December, 1931, when visiting the mountain with Professor W. M. Wheeler and party, I was astonished to find the same species appearing sparingly on Diggers' Creek, not only in the same places as those where *C. giganteus* appears six weeks later, but also much lower down. One of Professor Wheeler's party secured two specimens not far from the junction of the Snowy and Thredbo Rivers, at about 3,000 ft.

The species is easily distinguished from *C. giganteus*, n. sp., by its slenderer build, smaller size, lack of the brown band along costa of forewing in the imago and more especially by the strongly mottled wings of the subimago. The shape of the penis of the male is characteristic also.

It should be noted that, while both the newly described species have penes with each lobe subdivided into three processes, *C. haleuticus* Eaton has each lobe with only two processes, and the New Zealand species, *C. humeralis* (Walker), has the lobes undivided.

#### EXPLANATION OF PLATE I.

##### *Subimagos of the family Siphonuridae.*

(All figures slightly more than natural size.)

- 1-2. *Ameletoides lacus-albinae*, n.g. et sp. Fig. 1, male; fig. 2, female.  
 3-4. *Tasmanophlebia lacus-coerulei*, n. sp. Fig. 3, male; fig. 4, female.  
 5-6. *Tasmanophlebia nigrescens*, n. sp. Fig. 5, male; fig. 6, female.  
 7-8. *Coloburiscus giganteus*, n. sp. Fig. 7, male; fig. 8, female.  
 9-10. *Coloburiscus munionga*, n. sp. Fig. 9, male; fig. 10, female.

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